North Atlantic Right Whale (*Eubalaena glacialis*): Western Atlantic Stock 10

Humpback Whale (*Megaptera novaeangliae*): Gulf of Maine Stock 28

Fin Whale (*Balaenoptera physalus*): Western North Atlantic Stock 49

Sei Whale (*Balaenoptera borealis*): Nova Scotia Stock 62

Minke Whale (*Balaenoptera acutorostrata acutorostrata*): Canadian East Coast Stock 69

Sperm Whale (*Physeter macrocephalus*): North Atlantic Stock 82

Dwarf Sperm Whale: (*Kogia sima*): Western North Atlantic Stock 91

Pygmy Sperm Whale (*Kogia breviceps*): Western North Atlantic Stock 99

Cuvier's Beaked Whale (*Ziphius cavirostris*): Western North Atlantic Stock 107

Blainville's Beaked Whale (Mesoplodon densirostris): Western North Atlantic Stock 114

Gervais' Beaked Whale (*Mesoplodon europaeus*): Western North Atlantic Stock 122

Sowerby's Beaked Whale (*Mesoplodon bidens*): Western North Atlantic Stock 130

True's Beaked Whale (*Mesoplodon mirus*): Western North Atlantic Stock 138

Risso's Dolphin (*Grampus griseus*): Western North Atlantic Stock 146

Long-Finned Pilot Whale (*Globicephala melas*): Western North Atlantic Stock 155

Short-finned Pilot Whale (*Globicephala macrorhynchus*): Western North Atlantic Stock 173

White-Sided Dolphin (*Lagenorhynchus acutus*): Western North Atlantic Stock 190

Short-Beaked Common Dolphin (*Delphinus delphis delphis*): Western North Atlantic Stock 202

Striped Dolphin (*Stenella coeruleoalba*): Western North Atlantic Stock 214

Harbor Porpoise (*Phocoena phocoena*): Gulf of Maine/Bay of Fundy Stock 220

Harbor Seal (*Phoca vitulina concolor*): Western North Atlantic Stock 236

Gray Seal (*Halichoerus grypus grypus*): Western North Atlantic Stock 247

Harp Seal (*Pagophilus groenlandicus*): Western North Atlantic Stock 260

Atlantic Spotted Dolphin (*Stenella frontalis*): Western North Atlantic Stock 269

Pantropical Spotted Dolphin (*Stenella attenuata*): Western North Atlantic Stock 276

Rough-Toothed Dolphin *(Steno bredanensis)*: Western North Atlantic Stock 284

Clymene Dolphin (*Stenella clymene*): Western North Atlantic Stock 292

Spinner Dolphin: (*Stenella longirostris*): Western North Atlantic Stock 295

Bottlenose Dolphin (*Tursiops truncatus*): Western North Atlantic Offshore Stock 299

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Western North Atlantic Northern Migratory Coastal Stock 309

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Western North Atlantic Southern Migratory Coastal Stock 327

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Western North Atlantic South Carolina/Georgia Coastal Stock 345

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Western North Atlantic Northern Florida Coastal Stock.... 355

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Western North Atlantic Central Florida Coastal Stock 365

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Northern North Carolina Estuarine System Stock 375

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Southern North Carolina Estuarine System Stock 391

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Northern South Carolina Estuarine System Stock 404

Bottlenose Dolphin (*Tursiops truncatus*): Charleston Estuarine System Stock 409

Bottlenose Dolphin (*Tursiops truncatus*): Northern Georgia/Southern South Carolina Estuarine System Stock 419

Bottlenose Dolphin (*Tursiops truncatus*): Southern Georgia Estuarine System Stock 426

Bottlenose Dolphin (*Tursiops truncatus*): Jacksonville Estuarine System Stock 433

Bottlenose Dolphin (*Tursiops truncatus*): Indian River Lagoon Estuarine System Stock 440

Bottlenose Dolphin (*Tursiops truncatus*): Biscayne Bay Stock 453

Bottlenose Dolphin (*Tursiops truncatus*): Florida Bay Stock 459

Bottlenose Dolphin (*Tursiops truncatus truncatus*): Northern Gulf of Mexico Oceanic Stock 465

Risso's Dolphin (*Grampus griseus*): Northern Gulf of Mexico Stock 472

Appendix II: Five-year average rates of confirmed human-caused mortality and serious injury (SI) involving baleen whale stocks along the Gulf of Mexico Coast, US East Coast, and Atlantic Canadian Provinces, (2007-2011) 483

Appendix III: Fishery Descriptions 484

~~3173036415259657177838996107117123136145154161167173179184188191194201214228237245253264279286292297302311316321327334335~~

TABLE 1. A SUMMARY (including footnotes) OF ATLANTIC MARINE MAMMAL STOCK ASSESSMENT REPORTS FOR STOCKS OF MARINE MAMMALS UNDER NMFS AUTHORITY THAT OCCUPY WATERS UNDER USA JURISDICTION.

Total Annual S.I. (serious injury) and Mortality and Annual Fisheries S.I. and Mortality are mean annual figures for the period ~~2006~~2007-~~2010~~2011. The "SAR revised" column indicates ~~2012~~ 2013 stock assessment reports that have been revised relative to the ~~2011~~ 2012 reports (Y=yes, N=no). If abundance, mortality, PBR or status have been revised, they are indicated with the letters "a", "m", "p" and "status" respectively. For those species not updated in this edition, the year of last revision is indicated. Unk = unknown and undet=undetermined (PBR for species with outdated abundance estimates is considered "undetermined").

Species	Stock Area	NMFS Ctr.	Nbest	Nbest CV	Nmin	Rmax	Fr	PBR	Total Annual S.I and Mort.	Annual Fish. S.I. and Mort. (cv)	Strategic Status	SAR Revised
North Atlantic right whale	Western North Atlantic	NEC	~~444~~455	0	~~444~~455	0.04[a]	0.1	0.9	~~3.0~~4.05[a]	~~1.8~~3.25[a]	Y	Y a, m~~, p~~
Humpback whale	Gulf of Maine	NEC	823	0	823	0.065	0.1	2.7	~~7.8~~11.2[b]	~~5.8~~9.2[b]	Y	Y ~~a,~~ m~~, p~~
Fin whale	Western North Atlantic	NEC	3,522	0.27	2,817	0.04	0.1	5.6	~~2.0~~3.7[c]	~~0.8~~2.3[c]	Y	Y ~~a,~~ m~~, p~~
Sei whale	Nova Scotia	NEC	357	0.52	236	0.04	0.1	0.5	1.~~2~~[d]0[d]	0.~~6~~4[d]	Y	Y ~~a,~~ m~~, p~~
Minke whale	Canadian east coast	NEC	20,741	0.30	16~~.~~,199	0.04	0.5	162	~~5.0~~7.85[e]	~~4.6~~6.85[e]	N	Y ~~a,~~ m~~, p~~
Blue whale	Western North Atlantic	NEC	unk	unk	440	0.04	0.1	0.9	unk	unk	Y	N (2010)
Sperm whale	North Atlantic	NEC	~~1,593~~2,288	~~0.36~~0.28	~~1,187~~1,815	0.04	0.1	~~2.4~~3.6	0.~~6~~4	0.4	Y	Y a, m, p
Dwarf sperm whale	Western North Atlantic	SEC	~~1,042~~3,785[k]	~~0.65~~0.47[k]	~~632~~2,598[k]	0.04	0.5	~~6.3~~26	~~0~~3.4	~~0~~3.4 (1.0)	N	Y a, m, p
Pygmy sperm whale	Western North Atlantic	SEC	3,785~~741~~[k]	0.47[k] ~~0.40~~	2,598~~535~~[k]	0.04	0.5	2~~65.4~~	3.4~~0~~	3.4 (1.0)~~0~~	N	Y a, m, p
Killer whale	Western North Atlantic	NEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (1995)
Pygmy killer whale	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2007)
Northern bottlenose whale	Western North Atlantic	NEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2008)
Cuvier's beaked whale	Western North Atlantic	NEC	~~4,962~~6,532	~~0.37~~0.32	~~3,670~~5,021	0.04	0.5	~~37~~50	0.4	0.2	N	Y a, m, p
Blainville's beaked whale	Western North Atlantic	NEC	~~unk~~7,092[j]	~~unk~~0.54	~~unk~~4,632[j]	0.04	0.5	~~unk~~46	~~0~~0.2	~~0~~0.2	N	Y a, m, p~~)~~
Gervais beaked whale	Western North Atlantic	NEC	7,092[j]~~1,847~~	0.54~~0.96~~	4,632[j]~~935~~	0.04	0.5	~~9.4~~46	0	0	N	Y a, m, p
Sowerby's beaked whale	Western North Atlantic	NEC	7,092[j]~~3,653~~	0.54~~0.69~~	4,632[j]~~2,160~~	0.04	0.5	~~22~~46	0	0	N	Y a, m, p
True's beaked whale	Western North Atlantic	NEC	7,092[j]~~unk~~	0.54~~unk~~	4,632[j]~~unk~~	0.04	0.5	~~unk~~46	0	0	N	Y a, m, p

Melon-headed whale	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2007)
Risso's dolphin	Western North Atlantic	NEC	~~15,197~~18,250	~~0.55~~0.46	~~9,857~~12,619	0.04	0.48	~~95~~126	~~17~~62	~~17~~ 62 (0.~~51~~22)	N	Y a, m, p
Pilot whale, long-finned	Western North Atlantic	NEC	26,535~~12,619~~	0.~~37~~35	~~9,333~~19,930	0.04	0.5	~~93~~199	~~162~~ 44 [f]	~~162~~ 44 (0.15)	~~Y~~N	~~N~~Y (~~2011~~a, m, p, status)
Pilot whale, short-finned	Western North Atlantic	SEC	~~24,674~~21,515	~~0.45~~0.37	~~17,190~~15,913	0.04	0.5	~~172~~159	162[f]	162 (0.~~15~~18)	N	~~N~~ ~~(2011~~Y (a, m, p)
Atlantic white-sided dolphin	Western North Atlantic	NEC	48,819	0.61	30,401	0.04	0.5	304	~~212~~117	~~212~~ 117 (0.~~13~~17)	N	Y ~~a,~~ m~~, p~~
White-beaked dolphin	Western North Atlantic	NEC	2,003	0.94	1,023	0.04	0.5	10	0	0	N	N (2007)
Short-beaked common dolphin	Western North Atlantic	NEC	~~67,191~~173,486	~~0.29~~0.55	~~52,893~~112,531	0.04	0.5	~~529~~1,125	~~166~~168	~~166~~ 168 (0.~~11~~12)	N	Y a, m, p
Atlantic spotted dolphin	Western North Atlantic	SEC	~~26,798~~44.715	~~0.66~~0.43	~~16,151~~31,610	0.04	0.5	~~162~~316	~~0.2~~0	0	N	Y a,m,p
Pantropical spotted dolphin	Western North Atlantic	SEC	~~4,439~~3,333	~~0.49~~0.91	~~3,010~~1,733	0.04	0.5	~~30~~17	~~60~~	~~6 (1.0)~~0	N	~~N (2007)~~Y (a, m, p)
Striped dolphin	Western North Atlantic	NEC	~~46,882~~54,807	0.3~~3~~	~~35,763~~42,804	0.04	0.5	~~358~~428	0	0	N	Y a, m, p
Fraser's dolphin	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	N (2007)
Rough-toothed dolphin	Western North Atlantic	SEC	~~unk~~271	~~unk~~1.0	~~unk~~134	0.04	0.5	~~unk~~1.3	0	0	N	Y (a, m, p)~~N (2008)~~
Clymene dolphin	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	undet	0	0	N	~~N (2007)~~Y
Spinner dolphin	Western North Atlantic	SEC	unk	unk	unk	0.04	0.5	unk	0	0	N	~~N~~Y ~~(2007)~~
Bottlenose dolphin	Western North Atlantic, offshore	SEC	~~81,588~~77,532 [g]	~~0.17~~0.40	~~70,775~~56,053[g]	0.04	0.~~4~~5	~~566~~561	~~unk~~41.7	~~unk~~41.7 (0.26)	N	~~N (2008)~~ Y (a, m, p)
Bottlenose dolphin	Western North Atlantic, coastal, northern migratory	SEC	~~9,604~~11,548	0.36	~~7,147~~8,620	0.04	0.5	~~71~~86	~~5.9-8.2~~3.8-5.8	3.8-5.8~~5.9-8.2~~	Y	~~N (2010)~~Y (a, m, p)
Bottlenose dolphin	Western North Atlantic, coastal, southern migratory	SEC	~~12,482~~9,173	~~0.32~~0.46	~~9,591~~6,326	0.04	0.5	~~96~~63	~~24-55~~2.6-16.5	2.6-16.5~~24-55~~	Y	Y (a, m, p)~~N (2010)~~
Bottlenose dolphin	Western North Atlantic, coastal, S. Carolina/Georgia	SEC	~~7,738~~ 4,377	~~0.23~~0.43	~~6,399~~3,097	0.04	0.5	~~64~~31	unk	unk	Y	Y (a, m, p)~~N (2010)~~
Bottlenose dolphin	Western North Atlantic, coastal, northern Florida	SEC	~~3,064~~ 1,219	~~0.24~~0.67	~~2,511~~730	0.04	0.5	~~25~~7	unk	unk	Y	Y (a, m, p)~~N (2010)~~

Bottlenose dolphin	Western North Atlantic, coastal, central Florida	SEC	6,3184,895	0.260.71	5,0942,851	0.04	0.5	5129	unk	unk	Y	Y (a, m, p)N (2010)
Bottlenose dolphin	Northern North Carolina Estuarine System	SEC	950	0.23	785	0.04	0.5	7.9	4.1-22.61.9-9.1	1.9-9.14.1-22.6	Y	Y a, pY (m)
Bottlenose dolphin	Southern North Carolina Estuarine System	SEC	2,454188	0.530.19	1,614160	0.04	0.5	16	0.6-1.20.2-0.8	0.2-0.80.6-1.2	Y	N Y (2010a, m, p)
Bottlenose dolphin	Northern South Carolina Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	Y (new report)
Bottlenose dolphin	Charleston Estuarine System	SEC	unk289	unk0.03	unk281	0.04	0.5	unk2.8	unk	unk	Y	N (2009)Y (a, m, p)
Bottlenose dolphin	Northern Georgia/ Southern South Carolina Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2009)Y (m)
Bottlenose dolphin	Southern Georgia Estuarine System	SEC	unk194	unk0.05	unk185	0.04	0.5	unk1.9	unk	unk	Y	Y (a, m, p)N (2009)
Bottlenose dolphin	Jacksonville Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	Y (m)N (2009)
Bottlenose dolphin	Indian River Lagoon Estuarine System	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2009)Y (m)
Bottlenose dolphin	Biscayne Bay	SEC	unk	unk	unk	0.04	0.5	unk	unk	0.2unk	Y	N (2009)Y (m)
Bottlenose dolphin	Florida Bay	SEC	514unk	0.17unk	447unk	0.04	0.5	4.5undet	unk	unk	N	N (2009)Y (m)
Harbor porpoise	Gulf of Maine/Bay of Fundy	NEC	79,833	0.32	61,415	0.046	0.5	706	835719	835719	Y	Y a, m, p
Harbor seal	Western North Atlantic	NEC	unk70,142	unk0.29	unk48,980	0.12	0.5	undet1,469	342407	337 389 (0.1513)	N	Y a, m, p
Gray seal	Western North Atlantic	NEC	unk	unk	unk	0.12	1.0	unk	5,2504,980	850 1,120 (0.1411)	N	Y m
Harp seal	Western North Atlantic	NEC	unk	unk	unk	0.12	1.0	unk	379,673306,082[h]	282 271 (0.19)	N	Y m
Hooded seal	Western North Atlantic	NEC	unk	unk	unk	0.12	0.75	unk	5,199[i]	25(0.82)	N	N (2007)
Sperm whale	Gulf of Mexico Oceanic	SEC	763	0.38	560	0.04	0.1	1.1	0.2	0	Y	N (2012)Y a, m, p
Bryde's whale	Gulf of Mexico Oceanic	SEC	33	1.07	16	0.04	0.5	0.1	0.2	0	Y	N (2012)Y a, p
Cuvier's beaked whale	Gulf of Mexico Oceanic	SEC	74	1.04	36	0.04	0.5	0.4	0	0	N	N (2012)Y a, p

Blainville's beaked whale	Gulf of Mexico Oceanic	SEC	149[j]	0.91	77	0.04	0.5	0.8	0	0	N	N (2012)~~Y a, p~~
Gervais' beaked whale	Gulf of Mexico Oceanic	SEC	149[j]	0.91	77	0.04	0.5	0.8	0	0	N	N (2012)~~Y a, p~~
Bottlenose dolphin	Gulf of Mexico Continental shelf	SEC	unk	unk	unk	0.04	0.5	undet	unk	unk	N	N (2012)~~Y Stranding and fishery data~~
Bottlenose dolphin	Gulf of Mexico, eastern coastal	SEC	7,702	0.19	6,551	0.04	0.5	66	unk	unk	N	N (2012)~~Y Stranding and fishery data~~
Bottlenose dolphin	Gulf of Mexico, northern coastal	SEC	2,473	0.25	2,004	0.04	0.5	20	unk	unk	Y	N (2012)~~Y Stranding and fishery data~~
Bottlenose dolphin	Gulf of Mexico, western coastal	SEC	unk	unk	unk	0.04	0.5	undet	unk	unk	Y	N (2012)~~Y Stranding and fishery data~~
Bottlenose dolphin	Gulf of Mexico Oceanic	SEC	5,806	0.39	4,230	0.04	0.5	42	~~0.6~~3.1	~~0.6~~3.1 (~~1.0~~0.82)	N	Y ~~a,~~ m~~, p~~
Bottlenose dolphin	Gulf of Mexico bay, sound, and estuary (29 stocks)	SEC	unk for all but 4 stocks	unk	unk for all but 4 stocks	0.04	0.5	undet for all but 4 stocks	unk	unk	Y for all	N (2012)~~Y Stranding and fishery data~~
Bottlenose dolphin	Barataria Bay	SEC	unk	unk	unk	0.04	0.5	undet	unk	unk	Y	N (2012)~~Y Stranding and fishery data~~
Bottlenose dolphin	St. Joseph Bay	SEC	146	0.18	126	0.04	0.5	1.3	unk	unk	Y	N (2012)~~Y Stranding and fishery data~~
Bottlenose dolphin	Choctawhatchee Bay	SEC	179	0.04	173	0.04	0.5	1.7	unk	unk	Y	N (2012)~~Y Stranding and fishery data~~
Atlantic spotted dolphin	Gulf of Mexico (Continental shelf and Oceanic)	SEC	unk	unk	unk	0.04	0.5	undet	unk	unk	N	N (2012)~~Y Stranding and fishery data~~
Pantropical spotted dolphin	Gulf of Mexico Oceanic	SEC	50,880	0.27	40,699	0.04	0.5	407	3.2	3.2 (0.69)	N	N (2012)~~Y a, m, p~~
Striped dolphin	Gulf of Mexico Oceanic	SEC	1,849	0.77	1,041	0.04	0.5	10	0	0	N	N (2012)~~Y a, p~~
Spinner dolphin	Gulf of Mexico Oceanic	SEC	11,441	0.83	6,221	0.04	0.5	62	0	0	N	N (2012)~~Y a, p~~
Rough-toothed dolphin	Gulf of Mexico (Outer continental shelf and Oceanic)	SEC	624	0.99	311	0.04	0.5	3	0	0	N	N (2012)~~Y a, p~~
Clymene dolphin	Gulf of Mexico Oceanic	SEC	129	1.00	64	0.04	0.5	0.6	0	0	N	N (2012)~~Y a, p~~

Fraser's dolphin	Gulf of Mexico Oceanic	SEC	unk	unk	unk	0.04	0.5	undet	0	0	N	N (2012)~~Y a, p~~
Killer whale	Gulf of Mexico Oceanic	SEC	28	1.02	14	0.04	0.5	0.1	0	0	N	N (2012)~~Y a, p~~
False killer whale	Gulf of Mexico Oceanic	SEC	unk	unk	unk	0.04	0.5	undet	0	0	N	N (2012)~~Y a, p~~
Pygmy killer whale	Gulf of Mexico Oceanic	SEC	152	1.02	75	0.04	0.5	0.8	0	0	N	N (2012)~~Y a, p~~
Dwarf sperm whale	Gulf of Mexico Oceanic	SEC	186[k]	1.04	90	0.04	0.5	0.9	0	0	N	N (2012)~~Y a, p~~
Pygmy sperm whale	Gulf of Mexico Oceanic	SEC	186[k]	1.04	90	0.04	0.5	0.9	0.3	0.3 (1.0)	N	N (2012)~~Y a, m, p~~
Melon-headed whale	Gulf of Mexico Oceanic	SEC	2,235	0.75	1,274	0.04	0.5	13	0	0	N	~~Y~~ ~~a, p~~N (2012)
Risso's dolphin	Gulf of Mexico Oceanic	SEC	2,442	0.57	1,563	0.04	0.5	16	~~1.7~~2.0	~~1.7~~2.0 (0.~~63~~55)	N	Y ~~a,~~ m~~, p~~
Pilot whale, short-finned[l]	Gulf of Mexico Oceanic	SEC	2,415	0.66	1456	0.04	0.5	15	0	0	N	N (2012)~~Y a, p~~
Sperm Whale	Puerto Rico and US Virgin Islands stock	SEC	unk	unk	unk	0.04	0.1	unk	unk	unk	Y	N (2010)
Bottlenose dolphin	Puerto Rico and US Virgin Islands stock	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)
Cuvier's beaked whale	Puerto Rico and US Virgin Islands stock	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)
Pilot whale, short-finned	Puerto Rico and US Virgin Islands stock	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)
Spinner dolphin	Puerto Rico and US Virgin Islands stock	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)
Atlantic spotted dolphin	Puerto Rico and US Virgin Islands stock	SEC	unk	unk	unk	0.04	0.5	unk	unk	unk	Y	N (2011)

1. The R given for right whales is the default Rmax of 0.04. The total estimated human-caused mortality and serious injury to right whales is estimated at ~~3.0~~4.05 per year ~~(USA waters, 1.4; Canadian waters, 0.6)~~. This is derived from two components: 1) non-observed fishery entanglement records at ~~1.8~~3.25 per year ~~(USA waters, 1.6; Canadian waters, 0.2)~~, and 2) ship strike records at ~~1.2~~0.8 per year ~~(USA waters, 0.8; Canadian waters, 0.4)~~.
2. The total estimated human-caused mortality and serious injury to the Gulf of Maine humpback whale stock is estimated as ~~7.8~~11.2 per year ~~(USA waters, 7.6; Canadian waters, 0.2)~~. This average is derived from two components: 1) incidental fishery interaction records ~~5.8~~9.2 ~~(USA waters, 5.6; Canadian waters, 0.2)~~; 2) records of vessel collisions, 2.0 ~~(USA waters, 2.0; Canadian waters, 0)~~.
3. The total estimated human-caused mortality and serious injury to the Western North Atlantic fin whale stock is estimated as ~~2.0~~3.7 per year ~~(USA waters, 1.8; Canadian waters, 0.2)~~. This average is derived from two components: 1) incidental fishery interaction records ~~0.8~~2.3 ~~(USA waters, 0.6; Canadian waters, 0.2)~~; 2) records of vessel collisions, ~~1.2~~1.4 ~~(USA waters, 1.2; Canadian waters, 0)~~.
4. The total estimated human-caused mortality and serious injury to the Nova Scotia sei whale stock is estimated as ~~1.2~~1.0 per year ~~(USA waters, 1.0; Canadian waters, 0.2)~~. This average is derived from two components: 1) incidental fishery interaction records 0.~~6~~ 4~~(USA waters, 0.4; Canadian waters, 0.2)~~; 2) records of vessel collisions, 0.6 ~~(USA waters, 0.6; Canadian waters, 0)~~.

5. The total estimated human-caused mortality and serious injury to the Canadian East Coast minke whale stock is estimated as ~~5.0~~7.85 per year~~ (USA waters, 4.0; Canadian waters, 1.0)~~. This average is derived from ~~four~~ three components: 1) ~~2.6~~1.8 (0.~~46~~42) minke whales per year from observed U.S. fisheries; 2) ~~1.0~~5.05 minke whales per year (unknown CV) from U.S. and Canadian fisheries using strandings and entanglement data~~: 3) 1.0 (unknown CV) from Canadian fisheries using strandings and entanglement data~~; and ~~4~~3) ~~0.4~~1.0 per year from U.S. ship strikes
6. While abundance estimates have been attributed to each stock, the bycatch estimate for trawl fisheries includes both long-finned and short-finned pilot whales, and for the pelagic longline fishery has been assigned to the short-finned pilot whale stock.
7. Estimates may include sightings of the coastal form.

h. The total estimated human caused annual mortality and serious injury to harp seals is ~~379,673~~306,082. Estimated annual human caused mortality in US waters) ~~282~~ 271 harp seals CV=0.19) from the observed US fisheries. The remaining mortality is derived from five components: 1) ~~2006~~2007-~~2010~~ 2011 average catches of Northwest Atlantic harp seals by Canada, ~~188,646~~125,751; 2) ~~2006~~2007-~~2010~~ 2011 average Greenland Catch, ~~82,063~~79,181; 3) 1,000 average catches in the Canadian Arctic; 4) 12,330 average bycatches in the Newfoundland lumpfish fishery; and 5) ~~95,347~~87,546 average struck and lost animals.

i. This is derived from three components: 1) 5,173 from 2001-2005 (2001 = 3,960; 2002 = 7,341; 2003 = 5,446, 2004=5,270; and 2005=3,846) average catches of Northwest Atlantic population of hooded seals by Canada and Greenland; 2) 25 hooded seals (CV=0.82) from the observed U.S. fisheries; and 3) one hooded seal from average 2001-2005 stranding mortalities resulting from non-fishery human interactions.

j. This estimate includes Gervais' beaked whales and Blainville's beaked whales in the Gulf of Mexico and all species of *Mesoplodon* in the Atlantic.

k. This estimate ~~may~~ includes both the dwarf and pygmy sperm whales.

l. This estimate includes all *Globicephala sp.*, though it is presumed that only short-finned pilot whales are present in the Gulf of Mexico.

NORTH ATLANTIC RIGHT WHALE (*Eubalaena glacialis*): Western Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The western North Atlantic right whale population ranges primarily from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence. Mellinger *et al.* (2011) reported acoustic detections of right whales near the nineteenth-century whaling grounds east of southern Greenland, but the number of whales and their origin is unknown. However, Knowlton *et al.* (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland. In addition, ~~recent~~ resightings of photographically identified individuals have been made off Iceland, in the old Cape Farewell whaling ground east of Greenland (Hamilton *et al.* 2007), northern Norway (Jacobsen *et al.* 2004), and the Azores (~~Hamilton~~ Silva *et al.* 2012~~09~~). The September 1999 Norwegian sighting represents one of only two published sightings this century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. The few published records from the Gulf of Mexico (Moore and Clark 1963; Schmidly *et al.* 1972) represent either distributional anomalies, ~~normal~~ occasional wanderings of individual ~~occasional~~ animals, or a more extensive historic range beyond the sole known calving and wintering ground in the waters of the southeastern United States. Whatever the case, the location of much of the population is unknown during the winter. Offshore (greater than 30 miles) surveys flown off the coast of northeastern Florida and southeastern Georgia from 1996 to 2001 had 3 sightings in 1996, 1 in 1997, 13 in 1998, 6 in 1999, 11 in 2000 and 6 in 2001 (within each year, some were repeat sightings of previously recorded individuals). Several of the years that offshore surveys were flown were some of the lowest count years for calves and for numbers of right whales in the Southeast recorded since comprehensive surveys began in the calving grounds. Therefore, the frequency with which right whales occur in offshore waters in the southeastern U.S. remains unclear.

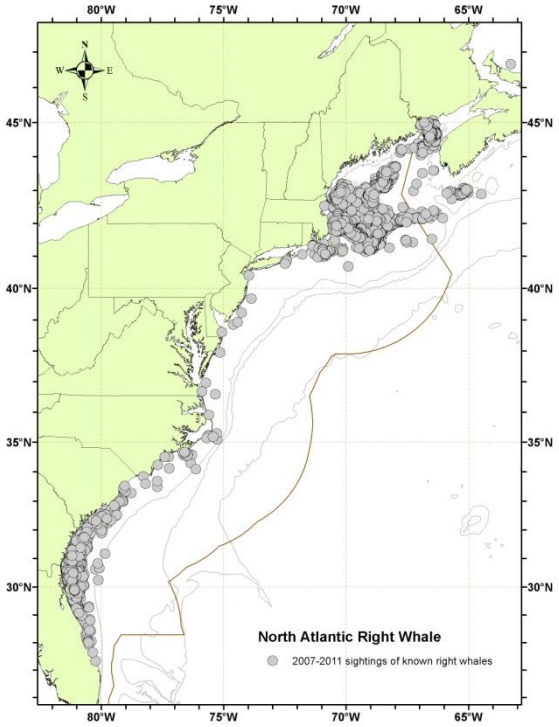


Figure 1. *Distribution of sightings of known North Atlantic right whales, 2007-2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Research results suggest the existence of six major habitats or congregation areas for western North Atlantic right whales: the coastal waters of the southeastern United States; the Great South Channel; Georges Bank/Gulf of Maine; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Scotian Shelf. However, movements within and between habitats are extensive and the area off the mid-Atlantic states is an important migratory corridor. In 2000, one whale was photographed in Florida waters on 12 January, then again eleven days later (23 January) in Cape Cod Bay, less than a month later off Georgia (16 February), and back in Cape Cod Bay on 23 March, effectively making the round-trip migration to the Southeast and back at least twice during the winter season (Brown and Marx 2000). Results from satellite tags clearly indicate that sightings separated by perhaps two weeks should not necessarily be assumed to indicate a stationary or resident animal. Instead, telemetry data have shown rather

lengthy and somewhat distant excursions, including into deep water off the continental shelf (Mate *et al.* 1997; Baumgartner and Mate 2005). Systematic surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted 8 calves, suggesting the calving grounds may extend as far north as Cape Fear. Four of the calves were not sighted by surveys conducted further south. One of the ~~cows~~ females photographed was new to researchers, having effectively eluded identification over the period of its maturation (McLellan *et al.* 2004). There is also at least one recent case of a calf apparently being born in the Gulf of Maine (Patrician *et al*. 2009).

New England waters are important feeding habitats for right whales, which feed in this area primarily on copepods (largely of the genera *Calanus* and *Pseudocalanus*). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall right whale habitats (Kenney *et al.* 1986, 1995). While feeding in the coastal waters off Massachusetts has been better studied than in other areas, right whale feeding has also been observed on the margins of Georges Bank, in the Great South Channel, in the Gulf of Maine, in the Bay of Fundy, and over the Scotian Shelf. The characteristics of acceptable prey distribution in these areas are beginning to emerge (Baumgartner *et al.* 2003; Baumgartner and Mate 2003). NMFS (National Marine Fisheries Service) and Provincetown Center for Coastal Studies aerial surveys during springs of 1999-2006 found right whales along the Northern Edge of Georges Bank, in the Great South Channel, in Georges Basin, and in various locations in the Gulf of Maine including Cashes Ledge, Platts Bank, and Wilkinson Basin. Analysis of the sightings data has shown that utilization of these areas has a strong seasonal component (Pace and Merrick 2008). The consistency with which right whales occur in such locations is relatively high, but these studies also highlight the high interannual variability in right whale use of some habitats (Pendleton *et al.* 2009)~~-~~. Right whale calls have been detected by autonomous passive acoustic sensors deployed between 2005 and 2010 at three sites (Massachusetts Bay, Stellwagen Bank and Jeffery's Ledge) in the southern Gulf of Maine (Morano ~~et al~~*et al*. 2012, Mussoline ~~et al~~*et al*. 2012). Acoustic Detections demonstrate that right whales are present more than aerial survey observations indicate. Comparisons between detections from passive acoustic recorders with observations from aerial surveys in Cape Cod Bay between 2001-2005 demonstrated that aerial surveys found whales on approximately two-thirds of the days during which acoustic monitoring ~~heard~~detected whales. (Clark ~~et al~~*et al*. 2010). Passive acoustic monitoring is demonstrating that the current understanding of the distribution and movements of right whales in the Gulf of Maine and surrounding waters is incomplete.

Genetic analyses based upon direct sequencing of mitochondrial DNA (mtDNA) have identified 7 mtDNA haplotypes in the western North Atlantic right whale, including hetroplasmy that led to the declaration of the 7th haplotype (Malik *et al.* 1999, McLeod and White 2010). Schaeff *et al.* (1997) compared the genetic variability of North Atlantic and southern right whales (*E. australis*), and found the former to be significantly less diverse, a finding broadly replicated by Malik *et al.* (2000). The low diversity in North Atlantic right whales might be indicative of inbreeding, but no definitive conclusion can be reached using current data. Additional work comparing modern and historic genetic population structure, using DNA extracted from museum and archaeological specimens of baleen and bone, has suggested that the eastern and western North Atlantic populations were not genetically distinct (Rosenbaum *et al.* 1997; 2000). However, the virtual extirpation of the eastern stock and its lack of recovery in the last hundred years strongly suggest~~s~~ population subdivision over a protracted (but not evolutionary) timescale. Genetic studies concluded that the principal loss of genetic diversity occurred prior to the 18th century (Waldick *et al.* 2002). However, revised conclusions that nearly all the remains in the North American Basque whaling archaeological sites were bowhead whales and not right whales (Rastogi *et al.* 2004) contradict the previously held belief that Basque whaling during the 16th and 17th centuries was principally responsible for the loss of genetic diversity.

High-resolution (i.e., using 35 microsatellite loci) genetic profiling has been completed for 66% of all ~~identified~~ North Atlantic right whales identified through 2001. This work has improved our understanding of genetic variability, number of reproductively active individuals, reproductive fitness, parentage and relatedness of individuals (Frasier *et al.* 2007).

One emerging result of the genetic studies is the importance of obtaining biopsy samples from calves on the calving grounds. Only 60% of all known calves are seen with their mothers in summering areas, when their callosity patterns are stable enough to reliably make a photo-ID match later in life. The remaining 40% are not seen on a known summering ground. Because the calf's genetic profile is the only reliable way to establish parentage, if the calf is not sampled when associated with its mother early on, then it is not possible to link it with a calving event or to its mother, and information such as age and familial relationships is lost. From 1980 to 2001, there were 64 calves born that were not sighted later with their mothers and thus unavailable to provide age-specific mortality

information (Frasier *et al.* 2007). An additional interpretation of paternity analyses is that the population size may be larger than was previously thought. Fathers for only 45% of known calves have been genetically determined. However, genetic profiles were available for 69% of all photo-identified males (Frasier 2005). The conclusion was that the majority of these calves must have different fathers that cannot be accounted for by the unsampled males and the population of males must be larger (Frasier 2005). This inference of additional animals that have never been captured photographically and/or genetically suggests the existence of habitats of potentially significant use that remain unknown. Since 2006, collaborators have sampled approximately 66% of the calves detected in the wintering grounds.

POPULATION SIZE

The western North Atlantic minimum stock size is based on a census of individual whales identified using photo-identification techniques. A review of the photo-ID recapture database as it existed on ~~21~~ 29 October ~~2011~~ 2012 indicated that ~~425~~ 455 individually recognized whales in the catalog were known to be alive during ~~2009~~2010. ~~Whales catalogued by this date included 20 of the 39 calves born during that year. Thus adding the 19 calves not yet catalogued brings the minimum number alive in 2009 to 444 (Figure 1).~~ This number represents a minimum population size. This count has no associated coefficient of variation.

Previous estimates using the same method with the added assumption that whales seen within the previous seven years were still alive have resulted in counts of 295 animals in 1992 (Knowlton *et al.* 1994) and 299 animals in 1998 (Kraus *et al.* 2001). An International Whaling Commission (IWC) workshop on status and trends of western North Atlantic right whales gave a minimum direct-count estimate of 263 right whales alive in 1996 and noted that the true population was unlikely to be substantially greater than this (Best *et al.* 2001).

Historical Abundance

An estimate of pre-exploitation population size is not available. Basque whalers were thought to have taken right whales during the 1500s in the Strait of Belle Isle region (Aguilar 1986), however, recent genetic analysis has shown that nearly all of the remains found in that area are, in fact, those of bowhead whales (Rastogi *et al.* 2004; Frasier *et al.* 2007). The stock of right whales may have already been substantially reduced by the time whaling was begun by colonists in the Plymouth area in the 1600s (Reeves *et al.* 2001; Reeves *et al.* 2007). A modest but persistent whaling effort along the coast of the eastern U.S. lasted three centuries, and the records include one report of 29 whales killed in Cape Cod Bay in a single day during January 1700. Based on incomplete historical whaling data, Reeves and Mitchell could conclude only that there were at least hundreds of right whales present in the western North Atlantic during the late 1600s. Reeves *et al.* (1992) plotted a series of population trajectories using historical data, assuming a present-day population size of 350 animals. The results suggested that there may have been at least 1,000 right whales in the population during the early to mid-1600s, with the greatest population decline occurring in the early 1700s. Reeves *et al*. (2007) revised that summary and state, "at least a few thousand whales present in the mid-1600s." The authors cautioned, however, that the record of removals is incomplete, the results were preliminary, and refinements are required. Based on back calculations using the present population size and growth rate, the population may have numbered fewer than 100 individuals by 1935 when international protection for right whales came into effect (Hain 1975; Reeves *et al.* 1992; Kenney *et al.* 1995). However, little is known about the population dynamics of right whales in the intervening years.

Minimum Population Estimate

The western North Atlantic population size was estimated to be at least ~~45~~5~~444~~455 individuals in 2010 (447 cataloged whales plus 8 not catalog~~u~~ed calves at the time the data were received)~~09~~ based on a census of individual whales identified using photo-identification techniques. This value is a minimum, and does not include animals that were alive prior to 2008~~,~~ but not recorded in the individual sightings database as seen during 1 December 2008 to 29~~1~~ October 2012~~1~~ (note that matching of photos taken during 2010-2012~~1~~ was not considered complete at the time these data were received, P. Hamilton, New England Aquarium, pers. com).

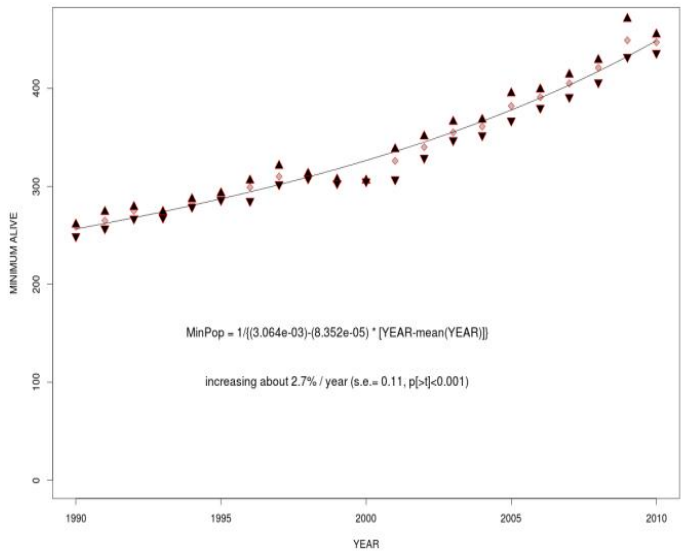
Current Population Trend

The population growth rate reported for the period 1986~~-~~–1992 by Knowlton *et al.* (1994) was 2.5% (CV=0.12), suggesting that the stock was showing signs of slow recovery, but that number may have been influenced by discovery phenomenon as existing whales were recruited to the catalog. Work by Caswell *et al.* (1999) suggested

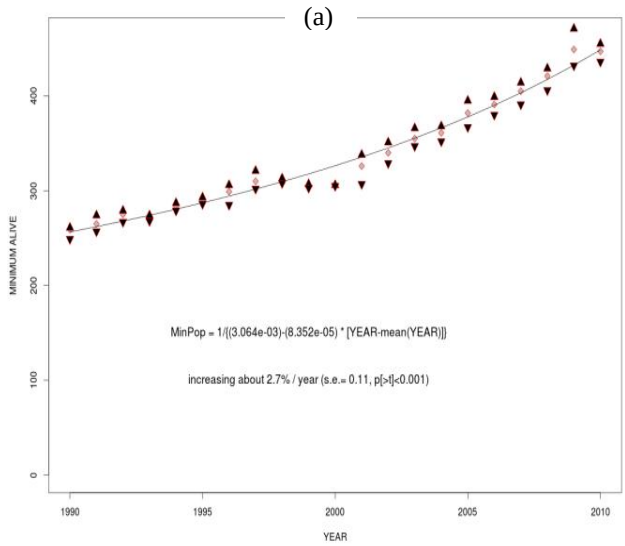
that crude survival probability declined from about 0.99 in the early 1980s to about 0.94 in the late 1990s. The decline was statistically significant. Additional work conducted in 1999 was reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop concluded based on several analytical approaches that survival had indeed declined in the 1990s. Although capture heterogeneity could negatively bias survival estimates, the workshop concluded that this factor could not account for the entire observed decline, which appeared to be particularly marked in adult females. Another workshop was convened by NMFS in September 2002, and it reached similar conclusions regarding the decline in the population (Clapham 2002). At the time, no one examined the early part of the recapture series for excessive retrospective recaptures which had the potential to positively bias survival as the catalog was being developed.

An increase in mortality in 2004 and 2005 was cause for serious concern (Kraus *et al.* 2005). Calculations based on demographic data through 1999 (Fujiwara and Caswell 2001) indicated that this mortality rate increase would reduce population growth by approximately 10% per year (Kraus *et al.* 2005). Of those mortalities, six were adult females, three of which were carrying near-term fetuses. Furthermore, four of these females were just starting to bear calves, losing their complete lifetime reproduction potential. Strong evidence for flat or negative growth exists in the time series of minimum number alive during 1998-2000, which coincided with very low calf production in~~,~~ 2004. However, the population has continued to grow~~th~~ since that apparent interval of decline ~~and 2005 appear to show good growth~~ (Figure 1).

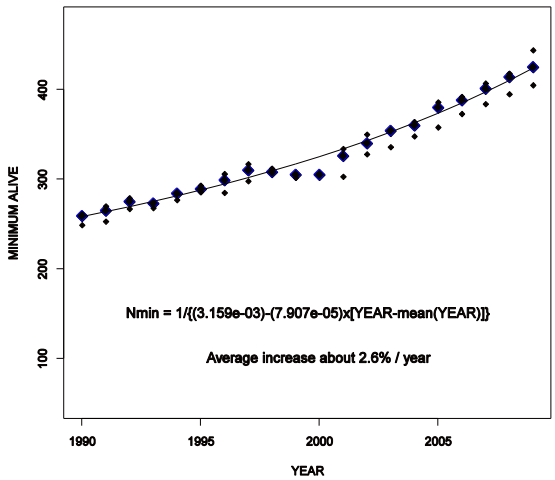
Examination of the minimum number alive population index calculated from the individual sightings database, as it existed on 21 October 2011, for the years 1990-2010~~09~~ (Figure 1) suggests a positive and slowly accelerating trend in population size. These data reveal a significant increase in the number of catalogued whales with a geometric mean growth rate for the period of 2.8~~6~~%.

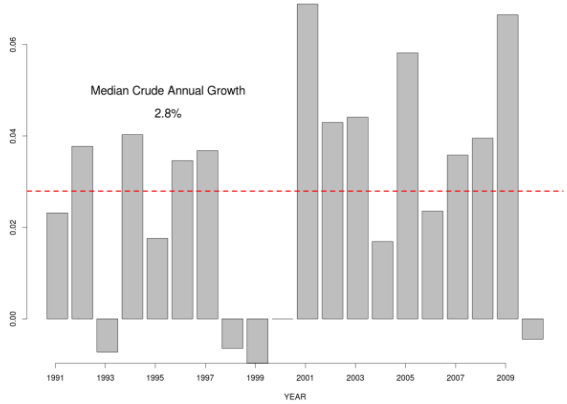


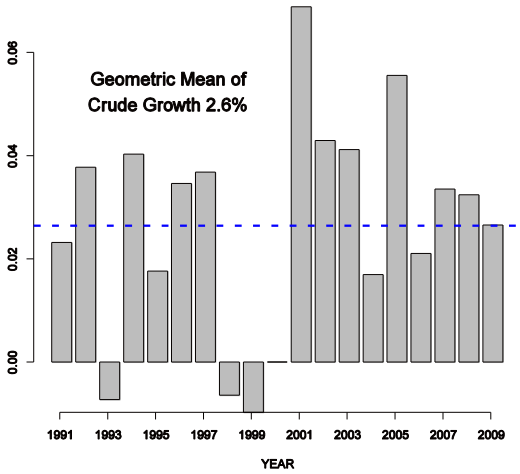
(a)


MINIMUM ALIVE
0
100
200
300
400
1990
1995
2000
2005
2010
YEAR
MinPop = 1/{(3.064e-03)-(8.352e-05) * [YEAR-mean(YEAR)]}
increasing about 2.7% / year (s.e.= 0.11, p[>t]<0.001)

(b)


MINIMUM ALIVE
100
200
300
400
1990
1995
2000
2005
YEAR
Nmin = 1/{(3.159e-03)-(7.907e-05)x[YEAR-mean(YEAR)]}
Average increase about 2.6% / year


0.00
0.02
0.04
0.06
Median Crude Annual Growth
2.8%
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
YEAR


0.00
0.02
0.04
0.06
Geometric Mean of
Crude Growth 2.6%
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
YEAR

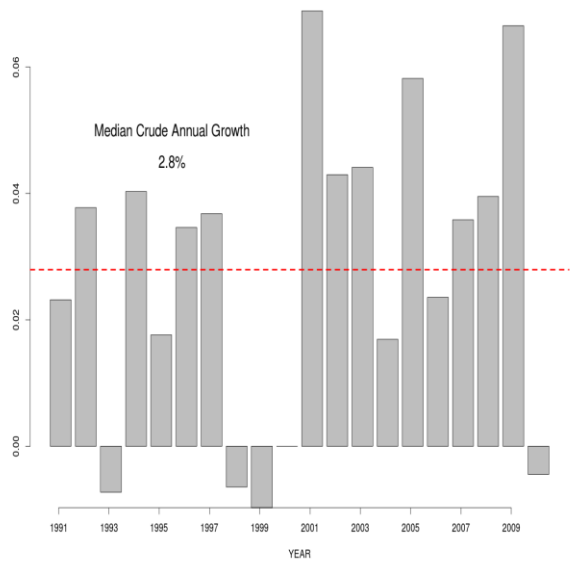


Figure 1. Minimum number alive (a) and crude annual growth rate (b) for cataloged North Atlantic right whales. Minimum number (N) of cataloged individuals known to be alive in any given year includes all whales known to be alive prior to that year and seen in that year or subsequently plus all whales newly cataloged that year. Cataloged whales may include some but not all calves produced each year. Bracketing the minimum number of cataloged whales is the number without calves (below) and that plus calves above, the latter which yields Nmin for purposes of stock assessment. Mean crude growth rate (dashed line) is the exponentiated mean of $\log_e [(N_{t+1}-N_t)/N_t]$ *for each year (t).*

The minimum number alive may increase slightly in later years as analysis of the backlog of unmatched but high-quality photographs proceeds. For example, the minimum number alive for 2002 was calculated to be 313 from a 15 June 2006 data set and revised to 325 using the 30 May 2007 data set.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

During 1980-1992, at least 145 calves were born to 65 identified ~~cows~~females. The number of calves born annually ranged from 5 to 17, with a mean of 11.2 (SE=0.90). The reproductively active female pool was static at approximately 51 individuals during 1987–1992. Mean calving interval, based on 86 records, was 3.67 years. There was an indication that calving intervals may have been increasing over time, although the trend was not statistically significant (P=0.083) (Knowlton *et al.* 1994). ~~Although moderately variable,~~Since 1993, calf production ~~appears to be increasing coincident with increasing population size~~has been more variable than a simple stochastic model would predict (Table 1).

Total reported calf production and calf mortalities from 1993 to ~~2009~~ 2011 are shown below in Table 1. The mean calf production for this ~~seventeen~~ nineteen year period was 17.~~2~~ 8 (~~15.3~~16.2-19.5~~ 19.4~~; 95% C.I.). During the 2004 and 2005 calving seasons three adult females were found dead with near-term fetuses.

An updated analysis of calving intervals through the 1997/1998 season suggests that the mean calving interval increased since 1992 from 3.67 years to more than 5 years, a significant trend (Kraus *et al.* 2001). This conclusion was supported by modeling work reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop agreed that calving intervals had indeed increased and further that the reproductive rate was approximately half that reported from studied populations of southern right whales, *E. australis*. A workshop on possible causes of reproductive failure was held in April 2000 (Reeves *et al.* 2001). Factors considered included contaminants, biotoxins, nutrition/food limitation, disease, and inbreeding problems. ~~While no conclusions were reached, a research plan to further investigate this topic was developed.~~ Analyses completed since that workshop found that in the early part of this century,~~most recent years~~, calving intervals were closer to 3 years (Kraus *et al.* 2007).

North Atlantic right whales have thinner blubber than southern right whales off South Africa (Miller *et al.* 2011). Blubber thickness of male North Atlantic right whales (males were selected to avoid the effects of pregnancy and lactation) varied with *Calanus* abundance in the Gulf of Maine (Miller *et al.* 2011). Sightings of North Atlantic right whales correlated with satellite-derived sea-surface chlorophyll concentration (as a proxy for productivity), and calving rates correlated with chlorophyll concentration prior to gestation (Hlista *et al.* 2009). On a regional scale, observations of North Atlantic right whales correlate well with copepod concentrations (Pendleton *et al.* 2009). The available evidence suggests that at least some of the observed variability in the calving rates of North Atlantic right whales is related to variability in nutrition.

An analysis of the age structure of this population suggests that it contains a smaller proportion of juvenile whales than expected (Hamilton *et al.* 1998; Best *et al.* 2001), which may reflect lowered recruitment and/or high juvenile mortality. Calf and perinatal mortality was estimated by Browning *et al.* (2010) to be between 17 and 45 animals during the period 1989 and 2003. In addition, it is possible that the apparently low reproductive rate is due in part to an unstable age structure or to reproductive senescence ~~on the part of~~in some females. However, few data are available on either factor and senescence has not been documented for any baleen whale.

The maximum net productivity rate is unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

Table 1. North Atlantic right whale calf production and mortality, 1993-~~2010~~2011.

Year[a]	Reported calf production	Reported calf mortalities
1993	8	2
1994	9	0
1995	7	0
1996	22	3
1997	20	1
1998	6	1
1999	4	0
2000	1	0
2001	31	4
2002	21	2
2003	19	0
2004	17	1
2005	28	0
2006	19	2
2007	23	2
2008	23	2
2009	39	1
2010	19	0
2011	22	0

[a]~~.~~ includes December of the previous year

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is the product of minimum population size, one-half the maximum net productivity rate and a recovery factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to OSP (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The recovery factor for right whales is 0.10 because this species is listed as endangered under the Endangered Species Act (ESA). The minimum population size is ~~444~~454. The maximum productivity rate is 0.04, the default value for cetaceans. PBR for the Western Atlantic stock of the North Atlantic right whale is 0.9.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period 2007~~6~~ through ~~2010~~2011, the minimum rate of annual human-caused mortality and serious injury

to right whales averaged ~~3.0~~4.05 per year~~ (U.S. waters, 2.4; Canadian waters, 0.6)~~. This is derived from two components: 1) incidental fishery entanglement records at ~~1.8~~3.25 per year~~ (U.S. waters, 1.6; Canadian waters, 0.2)~~, and 2) ship strike records at ~~1.2~~0.8 per year~~ (U.S. waters, 0.8; Canadian waters, 0.4)~~. Of the ~~8~~ 17 reported fisheries entanglements from U. S. waters during this 5-year time period that were classified as serious injury or mortality, ~~5~~ 4 were reported before the Atlantic Large Whale Take Reduction Plan's sinking-groundline rule went into effect in April 2009, and ~~3~~ 13 were reported after enactment of the rule. All 4 o~~O~~f the ~~4~~ reported ship strike serious injury and mortalities from U.S. waters during this 5-year time period~~, 3~~ were ~~in 2006 (prior to~~after the speed limit rule which went into effect in December 2009~~), and 1 was in 2010, after the rule was in effect~~. ~~Statistical analysis of the effectiveness of both of these rules is underway.~~Some analyses of the effectiveness of the ship strike rule were reported by Silber and Bettridge (2012). Beginning with the 2001 Stock Assessment Report, Canadian records ~~were~~ have been incorporated into the mortality and serious injury rates of this report to reflect the effective range of this stock. It is also important to stress that serious injury determinations are made based upon the best available information; these determinations may change with the availability of new information (Cole ~~et al~~*et al*~~. 2005~~and Henry *in prep.*). For the purposes of this report, discussion is primarily limited to those records considered confirmed human-caused mortalities or serious injuries. ~~For more information on determinations for this period, see Henry *et al.* (*2012*).~~ Annual rates calculated from detected mortalities should not be considered an unbiased estimate of human-caused mortality, but they represent a definitive lower bound. Detections are haphazard, incomplete and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is ~~almost certainly~~ biased low.

Background

The details of a particular mortality or serious injury record often require a degree of interpretation. The assigned cause is based on the best judgment of the available data; additional information may result in revisions. When reviewing Table 2 below, several factors should be considered: 1) a ship strike or entanglement may occur at some distance from the location where the animal is detected/reported~~ location~~; 2) the mortality or injury may involve multiple factors; for example, whales that have been both ship struck and entangled are not uncommon; 3) the actual vessel or gear type/source is often uncertain; and 4) in entanglements, several types of gear may be involved.

~~The serious injury determinations are susceptible to revision. There are several records where a struck and injured whale was re-sighted later, apparently healthy, or where an entangled or partially disentangled whale was re-sighted later free of gear. The reverse may also be true: a whale initially appearing in good condition after being struck or entangled is later re-sighted and found to have been seriously injured by the event. Entanglements of juvenile whales are typically considered serious injuries because the constriction on the animal is likely to become increasingly lethal as the whale grows (Cole *et al.* 2005; Nelson *et al.* 2007).~~

~~A serious injury was defined in 50 CFR part 229.2 as an injury that is likely to lead to mortality. We therefore limited the serious injury designation to only those reports that had substantiated evidence that the injury, whether from entanglement or vessel collision, was likely to lead to the whale's death (Cole *et al.* 2005; Henry *et al.* 2012). Determinations of serious injury were made on a case-by-case basis following recommendations from the workshop conducted in 1997 on differentiating serious and non-serious injuries (Angliss and DeMaster 1998). Injuries that impeded a whale's locomotion or feeding were not considered serious injuries unless they were likely to be fatal in the foreseeable future. There was no forecasting of how the entanglement or injury may increase the whale's susceptibility to further injury, namely from additional entanglements or vessel collisions. This conservative approach likely underestimates serious injury rates.~~

~~With these caveats, t~~The total minimum detected annual average human-induced mortality and serious injury incurred by this stock (including fishery and non-fishery related causes) for the period 2007~~6~~-2011~~10~~ was ~~3.0~~4.05 right whales per year~~ (U.S. waters 2.4; Canadian waters, 0.6)~~. As with entanglements, some injury or mortality due to ship strikes is almost certainly undetected, particularly in offshore waters. Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or necropsied) represent lost data, some of which may relate to human impacts. For these reasons, the estimate of ~~3.0~~4.05 right whales per year must be regarded as a minimum count~~ (Henry *et al.* 2012)~~.

Further, the small population size and low annual reproductive rate of right whales suggest that human sources of mortality may have a greater effect relative to population growth rates than for other whales. The principal factors believed to be retarding growth and recovery of the population are ship strikes and entanglement with fishing gear. Between 1970 and 1999, a total of 45 right whale mortalities was recorded (IWC 1999; Knowlton and Kraus 2001;

Glass *et al.* 2009). Of these, 13 (28.9%) were neonates that were believed to have died from perinatal complications or other natural causes. Of the remainder, 16 (35.6%) resulted from ship strikes, 3 (6.7%) were related to entanglement in fishing gear (in two cases lobster gear, and one gillnet gear), and 13 (28.9%) were of unknown cause. At a minimum, therefore, 42.2% of the observed total for the period and 50% of the 32 non-calf deaths ~~were~~ was attributable to human impacts (calves accounted for three deaths from ship strikes). Young animals, ages 0-4 years, are apparently the most impacted portion of the population (Kraus 1990).

Finally, entanglement or minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so that it is more likely to become vulnerable to further injury. Such was apparently the case with the two-year-old right whale killed by a ship off Amelia Island, Florida in March 1991 after having carried gillnet gear wrapped around its tail region since the previous summer (Kenney and Kraus 1993). A similar fate befell right whale #2220, found dead on Cape Cod in 1996.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998~~,~~; Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery-Related Serious Injury and Mortality

Reports of mortality and serious injury relative to PBR as well as total human impacts are contained in records maintained by the New England Aquarium and the NMFS Northeast and Southeast Regional Offices (Table 2). From ~~2006~~ 2007 through ~~2010~~2011, ~~9~~ 18 of ~~15~~ 21 records of mortality or serious injury (including records from both U.S. and Canadian waters) involved entanglement or fishery interactions. For this time frame, the average reported mortality and serious injury to right whales due to fishery entanglement was ~~1.8~~3.25 whales per year ~~(U.S. waters, 1.6; Canadian waters, 0.2)~~. Information from an entanglement event often does not include the detail necessary to assign the entanglements to a particular fishery or location.

Although disentanglement is often unsuccessful or not possible for many cases, ~~during the period 2006 through 2010, there were at least two~~there are several documented cases of entanglements for which the intervention of disentanglement teams averted a likely serious-injury determination. An adult female, #2029, first sighted entangled in the Great South Channel on 9 March 2007, may have avoided serious injury due to being partially disentangled on 18 September 2007 by researchers in the Bay of Fundy, Canada. On 8 December 2008, #3294 was successfully disentangled. Sometimes, even with disentanglement, an animal may die of injuries sustained from fishing gear. A female yearling right whale, #3107 was first sighted with gear wrapping its caudal peduncle on 6 July 2002 near Briar Island, Nova Scotia. Although the gear was removed on 1 September by the New England Aquarium disentanglement team, and the animal seen alive on an aerial survey on 1 October, its carcass washed ashore at Nantucket on 12 October, 2002 with deep entanglement injuries on the caudal peduncle. Additionally, but infrequently, a whale listed as seriously injured becomes gear-free without a disentanglement effort and is seen later in reasonable health. Such was the case for whale #1980, listed as a serious injury in 2008 but seen gear-free and apparently healthy in 2011. Three whales freed from probably fatal entanglements are known to have birthed calves at least once after their disentanglement, including 2 disentangled during the period 2007-2011.

~~In January 1997, NMFS changed the classification of the Gulf of Maine and U.S. mid-Atlantic lobster pot fisheries from Category III to Category I based on examination of stranding and entanglement records of large whales from 1990 to 1994 (62 FR 33, Jan. 2, 1997).~~

The only bycatch of a right whale observed by the Northeast Fisheries Observer Program was in the pelagic drift gillnet fishery in 1993. No mortalities or serious injuries have been documented in any of the other fisheries monitored by NMFS.

~~Entanglement records from 1990 through 2010 maintained by NMFS Northeast Regional Office (NMFS, unpublished data) included 74 confirmed right whale entanglements, including right whales in weirs, gillnets, and trailing line and buoys. Because w~~Whales often free themselves of gear following an entanglement event, and as such scarring may be a better indicator of fisheries interaction than entanglement records. A review of ~~30 years' (1980–2009)~~ scar~~sification of~~detected on identified individual right whales over a period of 30 years (1980–2009)

~~recorded~~documented 1032 definite, unique entanglements events on the 626 individual whales identified (Knowlton ~~et al~~*et al*. 2012). Most individual whales (83%) were entangled at least once, and almost half of them (306 of 626) were definitely entangled more than once. About a quarter of the individuals identified in each year (26%) were entangled in that year. Juveniles and calves were entangled at higher rates than were adults. Scarring rates suggest that entanglements are occurring at about an order of magnitude greater than that detected from observations of whales with gear on them.

Knowlton ~~et al~~*et al* (2012) concluded from their analysis of entanglement scar rates over time that efforts made since 1997 to reduce right whale entanglement have not worked. Working from a completely different data source (observed mortalities of eight large whale species, 1970-2009), van der Hoop ~~et al~~*et al*. (2012) arrived at a similar conclusion. Vessel strike and entanglements were the two leading causes of death for known mortalities of right whales for which a cause of death could be determined. Across all 8 species of large whales, there was no detectable change in causes of anthropogenic mortality over time (van der Hoop ~~et al~~*et al*. 2012).~~In an analysis of the scarification of right whales, 338 of 447 (75.6%) whales examined during 1980-2002 were scarred at least once by fishing gear (Knowlton *et al*. 2005). Further research using the North Atlantic Right Whale Catalogue has indicated that, annually, between 14% and 51% of right whales are involved in entanglements (Knowlton *et al*. 2005).~~

Incidents of entanglements in groundfish gillnet gear, cod traps, and herring weirs in waters of Atlantic Canada and the U.S. east coast were summarized by Read (1994). In six records of right whales that were entangled in groundfish gillnet gear in the Bay of Fundy and Gulf of Maine between 1975 and 1990, the whales were either released or escaped on their own, although several whales were observed carrying net or line fragments. A right whale mother and calf were released alive from a herring weir in the Bay of Fundy in 1976.

For all areas, specific details of right whale entanglement in fishing gear are often lacking. When direct or indirect mortality occurs, some carcasses come ashore and are subsequently examined, or are reported as "floaters" at sea. The number of unreported and unexamined carcasses is unknown, but may be significant in the case of floaters. More information is needed about fisheries interactions and where they occur.

Other Mortality

Ship strikes are a major cause of mortality and injury to right whales (Kraus 1990; Knowlton and Kraus 2001, van der Hoop ~~et al~~*et al* 2012). Records from ~~2006~~ 2007 through ~~2010~~ 2011 have been summarized in Table 2. For this time frame, the average reported mortality and serious injury to right whales due to ship strikes was ~~1.2~~0.8 whales per year ~~(U.S. waters, 0.8; Canadian waters, 0.4)~~.

Table 2. Confirmed human-caused mortality records of North Atlantic Right Whales (*Eubalaena glacialis*) where the cause was assigned as either an entanglement (EN) or a ship strike (SS): 2007-2011 [a]

Date[b]	Fate	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]
3/31/2007	Mortality		Outer Banks, NC	EN	1	US	NP
9/24/2008	Serious Injury	2110	Jeffreys Ledge, NH	EN	1	XU	NP
1/14/2009	Serious Injury	3311	~16 nm E of Brunswick, GA	EN	1	XU	GU
1/27/2009	Serious Injury	3710	Shoals off of Cape Lookout, NC	EN	1	XC	NP
7/18/2009	Unknown	1019	39 mi S of Nantucket Island	EN	0.75	XU	NR

8/9/2009	Serious Injury	3930	BOF	EN	1	XC	NP
6/27/2010	Mortality	-	off Cape May, NJ	EN	1	XU	NR
7/2/2010	Mortality	-	off Great Wass Island, ME	SS	1	XU	-
8/12/2010	Mortality	-	Digby Neck, NS	EN	1	XC	NP
9/10/2010	Serious Injury	1503	Jeffrey's Ledge	EN	1	XU	NR
12/25/2010	Serious Injury	3911	10 mi offshore Jacksonville Beach, FL	EN	1	XU	GU
1/20/2011	Serious Injury	3853	off South Carolina	SS	1	US	-
2/13/2011	Serious Injury	3993	22 mi SSE of Tybee, GA	EN	1	XU	NR
3/16/2011	Mortality	-	Cape Romain, SC	EN	1	XU	GU
3/27/2011	Serious Injury	-	Nags Head, NC	SS	1	US	-
3/27/2011	Mortality	1308	Nags Head, NC	SS	1	US	-
4/22/2011	Serious Injury	3302	S of Martha's Vineyard, MA	EN	1	XU	NR
7/19/2011	Serious Injury	2011 Calf of 2660	Off Race Point, Cape Cod	EN	1	XU	NP
9/3/2011	Serious Injury	2660	Gaspe Bay	EN	1	XC	NP
9/18/2011	Unknown	4090	Jeffrey's Ledge	EN	0.75	XU	NR
9/27/2011	Unknown	3111	10 mi E of Grand Manan Island, BOF	EN	0.75	XC	NR
Five-year totals		Shipstrike (US/CN/XU/XC)			0.80 (0.60/ 0.00/ 0.20/ 0.00)		
		Entanglement (US/CN/XU/XC)			3.25 (0.20/ 0.00/ 2.10/ 0.95)		

a. For more details on events please see Cole and Henry *in press* and Henry *et al. in press.*

b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)

d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir

~~Table 2. Confirmed human-caused mortality and serious injury records of Western North Atlantic right whales (Eubalaena glacialis), 2006—2010.~~

~~Date[a]~~	~~Report Type~~	~~Age, Sex, ID, Length~~	~~Location[a]~~	~~Assigned Cause: P=primary, S=secondary~~		~~Notes/Observations~~
				~~Ship Strike~~	~~Entanglement/ Fishery interaction~~	
~~1/10/06~~	~~mortality~~	~~Calf Male 5.4m w/out fluke~~	~~Jacksonville, FL~~	~~P~~	~~-~~	~~Propeller lacerations associated with hemorrhaging and edema; flukes completely severed~~
~~1/22/06~~	~~mortality~~	~~Calf Female[b] 5.6m~~	~~off Ponte Vedra Beach, FL~~	~~-~~	~~P~~	~~Significant premortem lesions from entanglement in apparent monofilament netting; no gear present~~
~~3/11/06~~	~~serious injury~~	~~Yearling Male #3522~~	~~Off Cumberland Island, GA~~	~~P~~	~~-~~	~~11 propeller lacerations across dorsal surface~~
~~7/24/06~~	~~mortality~~	~~age unknown Female 9.6m~~	~~Campobello Island, NB~~	~~P~~	~~-~~	~~Propeller lacerations through blubber, into muscle and ribs~~
~~8/24/06~~	~~mortality~~	~~Adult Female 14.7m~~	~~Roseway Basin, NS~~	~~P~~	~~-~~	~~16 fractured vertebrae; dorsal blubber bruise from head to genital region~~
~~12/30/06~~	~~mortality~~	~~Yearling Male #3508 12.6m~~	~~off Brunswick, GA~~	~~P~~	~~-~~	~~20 propeller lacerations along right side of head and back with associated hemorrhaging~~

~~3/31/07~~	~~mortality~~	~~Calf Male 7.7m~~	~~Outer Banks, NC~~	~~-~~	~~P~~	~~Edema associated with flipper and dorsal & ventral thoracic musculature; epidermal abrasion indicated entangling body and flipper wraps; no gear recovered~~
~~9/24/08[e]~~	~~serious injury~~	~~Adult Male #2110~~	~~Jeffreys Ledge~~	~~S~~	~~P~~	~~Spinal scoliosis associated with fresh entanglement injuries; compromised pectorals; emaciated; heavy cyamid load; pale skin; healed lacerations from previously documented vessel strike injury potentially exacerbate scoliosis; no gear present~~
~~1/14/09~~	~~serious injury~~	~~Juvenile sex unknown #3311~~	~~off Brunswick, GA~~	~~-~~	~~P~~	~~Partial disentanglement; embedded wrap in rostrum & lip removed; decline in health; fixed trap/pot gear~~
~~1/27/09~~	~~serious injury~~	~~Juvenile Male #3710 9.8m~~	~~Cape Lookout Shoals, NC~~	~~-~~	~~P~~	~~Live stranded w/ spinal scoliosis; euthanized; necropsy determined scoliosis due to entanglement and not congenital; entanglement wounds chronically infected; no gear recovered~~
~~6/27/10~~	~~mortality~~	~~Adult Male~~	~~off Cape May, NJ~~	~~-~~	~~P~~	~~Evidence of constricting rostrum, mouth & flipper wraps w/ associated hemorrhage and bone damage; no gear recovered~~
~~7/2/10~~	~~mortality~~	~~Calf Male 7.9m~~	~~off Grand Manan Island, ME~~	~~P~~	~~-~~	~~2 large lacerations from dorsal to ventral surface~~

~~8/12/10~~	~~mortality~~	~~Adult Male 14.1m~~	~~Digby Neck, NS~~	-	~~P~~	~~Evidence of entanglement with associated hemorrhaging around right flipper; no gear present~~
~~9/10/10~~	~~serious injury~~	~~Adult Female #1503~~	~~Jeffreys Ledge~~	-	~~p~~	~~Constricting rostrum wrap; evidence of health decline; no gear recovered~~
~~12/25/10~~	~~serious injury~~	~~Juvenile Female #3911~~	~~off Jacksonville, FL~~	-	~~p~~	~~Embedded line in mouth and on flipper; severe health decline; acute cause of death was shark predation; gear analysis pending~~

~~a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.~~
~~b. Additional information on previous event that was not included in previous reports.~~
~~c. Additional even not included in previous reports.~~

STATUS OF STOCK

The size of this stock is considered to be extremely low relative to OSP in the U.S. Atlantic EEZ, and this species is listed as endangered under the ESA. The North Atlantic right whale is considered one of the most critically endangered populations of large whales in the world (Clapham *et al.* 1999). A Recovery Plan has been published for the North Atlantic right whale and is in effect (NMFS 2005). NMFS is presently engaged in evaluating the need for critical habitat designation for the North Atlantic right whale. Under a prior listing as northern right whale, three critical habitats, Cape Cod Bay/Massachusetts Bay, Great South Channel, and the Southeastern U.S., were designated by NMFS (59 FR 28793, June 3, 1994). Two additional critical habitat areas in Canadian waters, Grand Manan Basin and Roseway Basin, were identified in Canada's final recovery strategy for the North Atlantic right whale (Brown *et al.* 2009). A National Marine Fisheries Service ESA status review in 1996 concluded that the western North Atlantic population ~~remains~~ remained endangered. This conclusion was reinforced by the International Whaling Commission (Best *et al.* 2001), which expressed grave concern regarding the status of this stock. Relative to populations of southern right whales, there are also concerns about growth rate, percentage of reproductive females, and calving intervals in this population. Subsequent status reviews by the National Marine Fisheries Service continue to affirm endangered status (NMFS 2006, NMFS Northeast Regional Office 2012). The total level of human-caused mortality and serious injury is unknown, but reported human-caused mortality and serious injury was a minimum of ~~3.0~~4.05 right whales per year from ~~2006~~ 2007 through ~~2010~~2011. Given that PBR has been set to 0.9, any~~no~~ mortality or serious injury for this stock can be considered ~~in~~significant. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and also because the North Atlantic right whale is an endangered species.

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HUMPBACK WHALE (*Megaptera novaeangliae*): Gulf of Maine Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, humpback whales feed during spring, summer and fall over a geographic range encompassing the eastern coast of the United States (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Katona and Beard 1990). Other North Atlantic feeding grounds occur off Iceland and northern Norway, including off Bear Island and, Jan Mayen and Franz Josef Land (Christensen *et al.* 1992; Palsbøll *et al.* 1997; M. Moore, WHOI, pers. comm.). These six regions represent relatively discrete subpopulations, fidelity to which is determined matrilineally (Clapham and Mayo 1987) and is supported by studies of the mitochondrial genome (Palsbøll *et al.* 1995.; Palsbøll *et al.* 2001) and individual animal movements (Stevick et al*et al.* 2006). Genetic analysis of mitochondrial DNA (mtDNA) has indicated that this fidelity has persisted over an evolutionary timescale in at least the Icelandic and Norwegian feeding grounds (Palsbøll *et al.* 1995; Larsen *et al.* 1996). In early stock assessment reportsPreviously, the North Atlantic humpback whale population was treated as a single stock for management purposes (Waring *et al.* 1999). Subsequently, . Indeed, earlier genetic analyses (Palsbøll *et al.* 1995), based upon relatively small sample sizes, had failed to discriminate among the four western North Atlantic feeding areas. However, genetic analyses often reflect a timescale of thousands of years, well beyond those commonly used by managers. Accordingly, the a decision was made to reclassify the Gulf of Maine as a separate feeding stock (Waring *et al.* 2000); this was based upon the strong fidelity by individual whales to this region, and the attendant assumption that, were this subpopulation wiped out, repopulation by immigration from adjacent areas would not occur on any reasonable management timescale. This reclassification has subsequently been supported by new genetic analyses based upon a much larger collection of samples than those utilized by Palsbøll *et al.* (1995). These analyses have found significant differences in mtDNA haplotype frequencies among whales sampled in four western feeding areas, including the Gulf of Maine (Palsbøll *et al.* 2001). During the 2002 Comprehensive Assessment of North Atlantic humpback whales, the International Whaling Commission acknowledged the evidence for treating the Gulf of Maine as a separate management unit (IWC 2002).

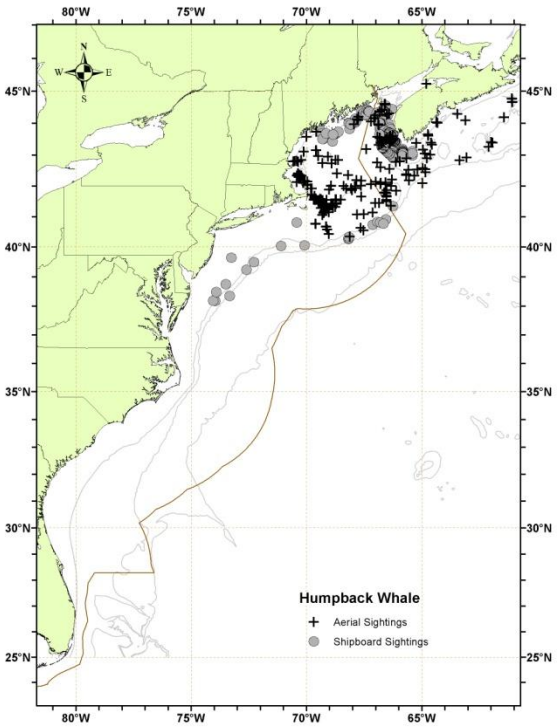

Figure 1. *Distribution of humpback whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

During the summers of 1998 and 1999, the Northeast Fisheries Science Center conducted surveys for humpback whales on the Scotian Shelf to establish the occurrence and population identity of the animals found in this region, which lies between the well-studied populations of the Gulf of Maine and Newfoundland. Photographs from both surveys were compared to both the overall North Atlantic Humpback Whale Catalogue and a large regional catalogue from the Gulf of Maine (maintained by the College of the Atlantic and the Provincetown Center for Coastal Studies, respectively); this work is summarized in Clapham *et al.* (2003). The match rate between the Scotian Shelf and the Gulf of Maine was 27% (14 of 52 Scotian Shelf individuals from both years). Comparable

rates of exchange were obtained from the southern (28%, n=10 of 36 whales) and northern (27%, *n*=4 of 15 whales) ends of the Scotian Shelf, despite the additional distance of nearly 100 nautical miles (one whale was observed in both areas). In contrast, all of the 36 humpback whales identified by the same NMFS surveys elsewhere in the Gulf of Maine (including Georges Bank, southwestern Nova Scotia and the Bay of Fundy) had been previously observed in the Gulf of Maine region. The sighting histories of the 14 Scotian Shelf whales matched to the Gulf of Maine suggested that many of them were transient through the latter area. There were no matches between the Scotian Shelf and any other North Atlantic feeding ground, except the Gulf of Maine; however, instructive comparisons are compromised by the often low sampling effort in other regions in recent years. Overall, it appears that the northern range of many members of the Gulf of Maine stock does not extend onto the Scotian Shelf.

During winter, whales from most North Atlantic feeding areas (including the Gulf of Maine) mate and calve in the West Indies, where spatial and genetic mixing among feeding groups occurs (Katona and Beard 1990; Clapham *et al.* 1993; Palsbøll *et al.* 1997; Stevick *et al.* 1998). A few whales likely using eastern North Atlantic feeding areas migrate to the Cape Verde Islands (Reiner *et al.* 1996; Wenzel *et al.* 2009). In the West Indies, the majority of whales are found in the waters of the Dominican Republic, notably on Silver Bank and Navidad Bank, and in Samana Bay (Balcomb and Nichols 1982; Whitehead and Moore 1982; Mattila *et al.* 1989; Mattila *et al.* 1994). Humpback whales are also found at much lower densities throughout the remainder of the Antillean arc, from Puerto Rico to the coast of Venezuela (Winn *et al.* 1975; Levenson and Leapley 1978; Price 1985; Mattila and Clapham 1989). –Although recognition of 2 breeding areas for North Atlantic humpbacks is the prevailing model, several observation suggests our knowledge of breeding season distribution is far from complete (see Smith –and Pike 2009).

~~Not a~~All whales from this stock may not migrate to the West Indies every winter, ~~and~~ because significant numbers of animals may be found in mid- and high-latitude regions at this time (Clapham *et al.* 1993; Swingle *et al.* 1993) and some individuals have been resighted across a winter season (Clapham *et al*. 1993; Robbins 2007). Acoustic recordings made on Stellwagen Bank National Marine Sanctuary in 2006 and 2008 detected humpback song in almost all months, including throughout the winter (Vu ~~et al~~*et al*. 2012). This confirms the presence of male humpback whales in the area (a mid-latitude feeding ground) through the winter in these years. In addition, photographic records from Newfoundland have shown a number of adult humpbacks remain there year-round, particularly on the island's north coast. In collaboration with colleagues in the French islands of St. Pierre and Miquelon, a new photographic catalogue and concurrent matching effort is being undertaken for this region (J. Lawson, DFO, pers. comm.).

An increased number of sightings of humpback whales in the vicinity of the Chesapeake and Delaware Bays occurred in 1992 (Swingle *et al.* 1993). Wiley *et al.* (1995) reported that 38 humpback whale strandings occurred during 1985-1992 in the U.S. mid-Atlantic and southeastern states. Humpback whale strandings increased, particularly along the Virginia and North Carolina coasts, and most stranded animals were sexually immature; in addition, the small size of many of these whales strongly suggested that they had only recently separated from their mothers. Wiley *et al.* (1995) concluded that these areas were becoming an increasingly important habitat for juvenile humpback whales and that anthropogenic factors may negatively impact whales in this area. There have also been a number of wintertime humpback sightings in coastal waters of the southeastern U.S. (NMFS unpublished data; New England Aquarium unpublished data). Whether the increased numbers of sightings represent a distributional change, or are simply due to an increase in sighting effort and/or whale abundance, is unknown.

A key question with regard to humpback whales off the southeastern and mid-Atlantic states is their population identity. This topic was investigated using fluke photographs of living and dead whales observed in the region (Barco *et al.* 2002). In this study, photographs of 40 whales (alive or dead) were of sufficient quality to be compared to catalogs from the Gulf of Maine (i.e., the closest feeding ground) and other areas in the North Atlantic. Of 21 live whales, 9 (43%) matched to the Gulf of Maine, 4 (19%) to Newfoundland and 1 (4.8%) to the Gulf of St Lawrence. Of 19 dead humpbacks, 6 (31.6%) were known Gulf of Maine whales. Although the population composition of the mid-Atlantic is apparently dominated by Gulf of Maine whales, lack of ~~recent~~ photographic effort in Newfoundland makes it likely that the observed match rates under-represent the true presence of Canadian whales in the region. A new photographic catalog and concurrent matching effort is being undertaken for this region which may improve knowledge in this regard. Barco *et al.* (2002) suggested that the mid-Atlantic region primarily represents a supplemental winter feeding ground used by humpbacks.

In New England waters, feeding is the principal activity of humpback whales, and their distribution in this region has been largely correlated to abundance of prey species, although behavior and ~~bottom topography~~bathymetry are factors influencing foraging strategy (Payne *et al.* 1986, 1990). Humpback whales are

frequently piscivorous when in New England waters, feeding on herring (*Clupea harengus*), sand lance (*Ammodytes* spp.), and other small fishes. In the northern Gulf of Maine, euphausiids are also frequently taken (Paquet *et al.* 1997). Commercial depletion of herring and mackerel led to an increase in sand lance in the southwestern Gulf of Maine in the mid-1970s, with a concurrent decrease in humpback whale abundance in the northern Gulf of Maine. Humpback whales were densest over the sandy shoals in the southwestern Gulf of Maine favored by the sand lance during much of the late 1970s and early 1980s, and humpback distribution appeared to have shifted to this area (Payne *et al.* 1986). An apparent reversal began in the mid-1980s, and herring and mackerel increased as sand lance again decreased (Fogarty *et al.* 1991). Humpback whale abundance in the northern Gulf of Maine increased markedly during 1992-1993, along with a major influx of herring (P. Stevick, pers. comm.). Humpback whales were few in nearshore Massachusetts waters in the 1992-1993 summer seasons. They were more abundant in the offshore waters of Cultivator Shoal and on the Northeast Peak on Georges Bank and on Jeffreys Ledge; these latter areas are traditional locations of herring occurrence. In 1996 and 1997, sand lance and therefore humpback whales were once again abundant in the Stellwagen Bank area. However, unlike previous cycles, when an increase in sand lance corresponded to a decrease in herring, herring remained relatively abundant in the northern Gulf of Maine, and humpbacks correspondingly continued to occupy this portion of the habitat, where they also fed on euphausiids (Wienrich *et al.* 1997). Diel patterns in humpback foraging behavior have been shown to correlate with diel patterns in sand lance behavior (Friedlaender *et al.* 2009).

In early 1992, a major research program known as the Years of the North Atlantic Humpback (YONAH) (Smith *et al.* 1999) was initiated. This was a large-scale, intensive study of humpback whales throughout almost their entire North Atlantic range, from the West Indies to the Arctic. During two primary years of field work, photographs for individual identification and biopsy samples for genetic analysis were collected from summer feeding areas and from the breeding grounds in the West Indies. Additional samples were collected from certain areas in other years. Results pertaining to the estimation of abundance and to genetic population structure are summarized below.

As part of a large-scale assessment called More of North Atlantic Humpbacks (MoNAH) project, extensive sampling was conducted on humpbacks in the Gulf of Maine/Scotian Shelf region and the primary wintering ground on Silver Bank during 2004-2005. These data are being analyzed along with additional data from the Gulf of Maine to estimate abundance and refine knowledge of the North Atlantic humpback whales' population structure. The work is intended to update the YONAH population assessment.

POPULATION SIZE

North Atlantic Population

The overall North Atlantic population (including the Gulf of Maine), derived from genetic tagging data collected by the YONAH project on the breeding grounds, was estimated to be 4,894 males (95% CI=3,374-7,123) and 2,804 females (95% CI=1,776-4,463) (Palsbøll *et al.* 1997). Because the sex ratio in this population is known to be even (Palsbøll *et al.* 1997), the excess of males is presumed a result of sampling bias, lower rates of migration among females, or sex-specific habitat partitioning in the West Indies; whatever the reason, the combined total is an underestimate of overall population size. Photographic mark-recapture analyses from the YONAH project provided an ocean-basin-wide estimate of 11,570 animals during 1992/1993 (CV=0.068, Stevick *et al.* 2003), and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 whales (CV=0.138, 95% CI=8,000 to 13,600) (Smith *et al.* 1999). ~~In the northeastern North Atlantic, Øien (2001) estimated from sighting survey data that there were 889 (CV=0.32) humpback whales in the Barents and Norwegian Seas region.~~

~~As part of a large-scale assessment called More of North Atlantic Humpbacks (MoNAH) project, extensive sampling was conducted on humpbacks in the Gulf of Maine/Scotian Shelf region and the primary wintering ground on Silver Bank during 2004-2005. These data are being analyzed along with additional data from the Gulf of Maine to estimate abundance and refine knowledge of the North Atlantic humpback whales' population structure. The work is intended to update the YONAH population assessment. Abundance estimates from the MoNAH project are not yet available.~~

Gulf of Maine stock - earlier estimates

Please see Appendix IV for earlier estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Gulf of Maine Stock - Recent surveys and abundance estimates

~~An abundance estimate of 359 (CV=0.75) humpback whales was obtained from a line-transect sighting survey conducted from 12 June to 4 August 2004 by a ship and plane. The 2004 survey covered a small portion of the habitat (6,180 km of trackline), from the 100-m depth contour on the southern Georges Bank to the lower Bay of Fundy; while the Scotian Shelf south of Nova Scotia was not surveyed.~~

An abundance estimate of 847 animals (CV=0.55) was derived from a line-transect sighting survey conducted during August 2006, which covered 10,676 km of trackline from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the Gulf of St. Lawrence (Table 1; Palka pers. comm.). Photo-identification evidence indicates a 25% exchange rate between whales on the Scotian Shelf and the catalogued Gulf of Maine population (Clapham *et al.* 2003), which suggest that a 25% correction factor should be applied to the humpback population estimate from the Scotian Shelf stratum. Because the Scotian Shelf was surveyed during 2006, the 25% correction factor was applied to only the 2006 abundance estimate. In contrast to 2006, a line-transect based abundance estimate for humpbacks on the Scotian Shelf based on the 2007 Canadian component of the Trans-North Atlantic Sighting Survey (TNASS) survey was 2,612 (CV=0.26) whales (Lawson and Gosselin 2011).

An abundance of 335 (CV=0.42) humpback whales was estimated from a line-transect survey conducted during June-August 2011 by ship and plane (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a two-simultaneous-team data collection procedure, which allows estimation of abundance corrected for perception bias (Laake and Borchers, 2004). Estimation of abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). This estimate did not include the portion of the Scotian Shelf that is known to be part of the range used by Gulf of Maine humpback whales. These various line-transect surveys lack consistency in geographic coverage, and because of the mobility of humpback whales, pooling stratum estimates across years to produce a single estimate is not advisable. However, similar to an estimate that appeared in Clapham *et al.* (2003), J. Robbins (Provincetown Center for Coastal Studies, Pers comm.) ~~(2010)~~ used photo-id evidence of presence (see Robbins 2009, 2010, 2011 for data description) to calculate the minimum number alive of catalogued individuals seen during the 2008 feeding season within the Gulf of Maine, or seen both before and after 2008, plus whales seen for the first time as non-calves in 2009. That procedure placed the minimum number alive at 823 animals.

Minimum Population Estimate

For statistically-based estimates, the minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The most recent line-transect survey, which did not include the Scotian Shelf portion of the stock, produced an estimate of abundance for Gulf of Maine humpback whales of 331 animals (CV=0.48) with a resultant minimum population estimate for this stock of 228 animals. The line-transect based Nmin is unrealistic because at least 500 uniquely identifiable individual whales from the GOM stock were seen during the calendar year of that survey and the actual population would have been larger because re-sighting rates of GOM humpbacks have historically been <1 (Robbins 2007). ~~-~~Using the minimum count from at least 2 years prior to the year of a stock assessment report allows time to resight whales known to be alive prior to and after the focal year. Thus, the minimum population estimate is set to the 2008 mark-recapture based count of 823.

Table 1. Summary of abundance estimates for Gulf of Maine humpback whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV). Note that the second row represents the results from an analysis resights of individually identified animals.

Month/Year	Type	N_{best}	CV
~~Jun-Jul 2004~~	~~Gulf of Maine to lower Bay of Fundy~~	~~359~~	~~0.75~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	847	0.55

Jun-Oct 2008	Gulf of Maine and Bay of Fundy	823	0
Jun-Aug 2011	~~North Carolina~~Virginia to lower Bay of Fundy	335	0.42

Current Population Trend

As detailed below, the most recent available~~current~~ data suggest that the Gulf of Maine humpback whale stock is characterized by a ~~steadily increasing~~positive trend in size. This is consistent with an estimated average trend of 3.1% (SE=0.005) in the North Atlantic population overall for the period 1979-1993 (Stevick *et al.* 2003), although there are no feeding-area-specific estimates.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Zerbini *et al.* (2010) reviewed various estimates of maximum productivity rates for humpback whale populations, and, based on simulation studies, they proposed that 11.8% be considered as the maximum rate at which the species could grow. Barlow and Clapham (1997), applying an interbirth interval model to photographic mark-recapture data, estimated the population growth rate of the Gulf of Maine humpback whale stock at 6.5% (CV=0.012). Maximum net productivity is unknown for this population, although a theoretical maximum for any humpback population can be calculated using known values for biological parameters (Brandão *et al.* 2000; Clapham *et al.* 2001). For the Gulf of Maine stock, data supplied by Barlow and Clapham (1997) and Clapham *et al.* (1995) give values of 0.96 for survival rate, 6 years as mean age at first parturition, 0.5 as the proportion of females, and 0.42 for annual pregnancy rate. From this, a maximum population growth rate of 0.072 is obtained according to the method described by Brandão *et al.* (2000). This suggests that the observed rate of 6.5% (Barlow and Clapham 1997) is close to the maximum for this stock.

Clapham *et al.* (2003) updated the Barlow and Clapham (1997) analysis using data from the period 1992 to 2000. The population growth estimate was either 0% (for a calf survival rate of 0.51) or 4.0% (for a calf survival rate of 0.875). Although confidence limits were not provided (because maturation parameters could not be estimated), both estimates of population growth rate are outside the 95% confidence intervals of the previous estimate of 6.5% for the period 1979 to 1991 (Barlow and Clapham 1997). More recent work by Robbins (2007) places apparent survival of calves at 0.664 (95% CI: 0.517-0.784), a value intermediate between those used by Barlow and Clapham (1997).

Despite the uncertainty accompanying the more recent estimates of observed population growth rate for the Gulf of Maine stock, the maximum net productivity rate was assumed to be 6.5% calculated by Barlow and Clapham (1997) because it represents an observation greater than the default of 0.04 for cetaceans (Barlow *et al.* 1995) but is conservative in that it is well below the results of Zerbini *et al.* (2010).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Gulf of Maine stock is 823 whales. The maximum productivity rate is 0.065. The recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because this stock is listed as an endangered species under the Endangered Species Act (ESA). PBR for the Gulf of Maine humpback whale stock is 2.7 whales.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period 2007~~6~~ through 2011~~10~~, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged ~~10.9~~~~7.8~~11.2 animals per year~~ (U.S. waters, 9.87.2; Canadian waters, 1.10.6)~~. This value includes incidental fishery interaction records, ~~9.1~~~~5.8~~9.2~~ (U.S. waters, 8.15.2; Canadian waters, 1.00.6)~~; and records of vessel collisions, 2.0~~ (U.S. waters, 2.0; Canadian waters, 0)~~ (Table 2; Henry *et al.* ~~2013~~2*in press*~~.~~; Cole and Henry *in prep.*)~~.~~.

In contrast to stock assessment reports before 2007, these averages include humpback mortalities and serious injuries that occurred in the southeastern and mid-Atlantic states that could not be confirmed as involving members of the Gulf of Maine stock. In past reports, only events involving whales confirmed to be members of the Gulf of

Maine stock were counted against the PBR. Starting in the 2007 report, we assumed whales were from the Gulf of Maine unless they were identified as members of another stock. At the time of this writing, no whale was identified as a member of another stock. These determinations may change with the availability of new information. Canadian records from the southern side of Nova Scotia were incorporated into the mortality and serious injury rates, to reflect the effective range of this stock as described above. For the purposes of this report, discussion is primarily limited to those records considered confirmed human-caused mortalities or serious injuries.

Serious injury was defined in 50 CFR part 229.2 as an injury that is likely to lead to mortality. We therefore limited serious injury designations to only those reports that had substantiated evidence that the injury, whether from entanglement or vessel collision, was likely to lead to the whale's death. Determinations of serious injury were made on a case-by-case basis following recommendations from the workshop conducted in 1997 on differentiating serious and non-serious injuries (Angliss and DeMaster 1998). Injuries that impeded a whale's locomotion or feeding were not considered serious injuries unless they were likely to be fatal in the foreseeable future. There was no forecasting of how the entanglement or injury might increase the whale's susceptibility to further injury, namely from additional entanglements or vessel collisions. For these reasons, the human impacts listed in this report represent a minimum estimate.

To better assess human impacts (both vessel collision and gear entanglement) there needs to be greater emphasis on the timely recovery of carcasses and complete necropsies. The literature and review of records described here suggest that there are significant human impacts beyond those recorded in the data assessed for serious injury and mortality. For example, a study of entanglement-related scarring on the caudal peduncle of 134 individual humpback whales in the Gulf of Maine suggested that between 48% and 65% had experienced entanglements (Robbins and Mattila 2001). Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or no necropsy performed) represent 'lost data', some of which may relate to human impacts.

Background

As with right whales, human impacts (vessel collisions and entanglements) may be slowing recovery of the humpback whale population. Van der Hoop *et al.* (2012) reviewed 1762 mortalities and serious injuries recorded for 8 species of large whales in the Northwest Atlantic for the 40 years 1970-2009. Of 473 records of humpback whales, cause of death could be attributed for 203. Of the 203, 116 (57%) mortalities were caused by entanglements in fishing gear, and 31 (15%) were attributable to vessel strikes.

~~Of 20 dead humpback whales (principally in the mid-Atlantic, where decomposition did not preclude examination for human impacts), Wiley *et al.* (1995) reported that six (30%) had major injuries possibly attributable to ship strikes, and five (25%) had injuries consistent with entanglement in fishing gear. One whale displayed scars that may have been caused by both ship strike and entanglement. Thus, 60% of the whale carcasses suitable for examination showed signs that anthropogenic factors may have contributed to, or been responsible for, their death. Wiley *et al.* (1995) further reported that all stranded animals were sexually immature, suggesting a winter or migratory segregation and/or that juvenile animals are more susceptible to human impacts.~~

~~An updated analysis of humpback whale mortalities from the mid-Atlantic region was produced by Barco *et al.* (2002). Between 1990 and 2000, there were 52 known humpback whale mortalities in the waters of the U.S. mid-Atlantic states. Inspection of length data from 48 of these whales (18 females, 22 males, and 8 of unknown sex) suggested that 39 (81.2%) were first-year animals, 7 (14.6%) were immature, and 2 (4.2%) were adults. However, sighting histories of five of the dead whales indicate that some were small for their age, and histories of live whales further indicate that the proportion of mature whales in the mid-Atlantic may be higher than suggested by the stranded sample.~~

Robbins and Mattila (2001) reported that males were more likely to be entangled than females. Annually updated inferences made from scar prevalence and multistate models of GOM humpback whales ~~Their scarring data suggested that yearlings were more likely than other age classes to be involved in entanglements~~that (1) younger animals are more likely to become entangled than adults, (2) juvenile scarring rates may be trending up (3) maybe less than 10% of humpback entanglements are ever reported and (4) 3 % of the population maybe dying annually as the result of entanglements (Robbins 2009, 2010, 2011, 2012). Humpback whale entanglements also occur in relatively high numbers in Canadian waters. Reports of interactions with fixed fishing gear set for groundfish around Newfoundland averaged 365 annually from 1979 to 1987 (range 174-813). An average of 50 humpback whale entanglements (range 26-66) was reported annually between 1979 and 1988, and 12 of 66 humpback whales entangled in 1988 died (Lien *et al.* 1988). A total of 965 humpbacks were reported entangled in fishing gear in Newfoundland and Labrador from 1979 to 2008 (Benjamins *et al.* 2011). Volgenau *et al.* (1995) reported that in

Newfoundland and Labrador, cod traps caused the most entanglements and entanglement mortalities (21%) of humpbacks between 1979 and 1992. They also reported that gillnets were the primary cause of entanglements and entanglement mortalities (20%) of humpbacks in the Gulf of Maine between 1975 and 1990. In more recent times, following the collapse of the cod fishery, groundfish gillnets for other fish species and crab pot lines have been the most common sources of humpback entanglement. Since the crab pot fishery is primarily an offshore activity on the Grand Banks, these entanglements are hard to respond to and are likely underreported. One humpback whale was reported released alive (status unknown) from a herring weir off Grand Manan in 2009 (H. Koopman, UNC Wilmington, pers. comm.).

Wiley *et al.* (1995) reported serious injuries attributable to ship strikes are more common and probably more serious than those from entanglements, but this claim is not supported by more recent analysis (van der Hoop *et al.* 2012).~~As reported by Wiley *et al.* (1995), serious injuries possibly attributable to ship strikes are more common and probably more serious than those from entanglements (But see Van der Hoop et al*et al* 2012).~~ ~~However~~Furthermore, in the NMFS records for ~~2006~~ 2007 through ~~2010~~2011, there are 10 reports of serious injuries and mortalities as a result of collision with a vessel and ~~29~~ 50 serious injuries and mortalities attributed to entanglement. Because it has never been shown that serious injuries and mortalities related to ships or to fisheries interactions are equally detectable, it is unclear as to which human source of mortality is more prevalent. No whale involved in the recorded vessel collisions had been identified as a member of a stock other than the Gulf of Maine stock at the time of this writing (Henry *et al.* ~~2012~~in press).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). ~~-~~NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery-Related Serious Injuries and Mortalities

A description of fisheries is provided in Appendix III. Two mortalities were observed in the pelagic drift gillnet fishery, one in 1993 and the other in 1995. In winter 1993, a juvenile humpback was observed entangled and dead in a pelagic drift gillnet along the 200-m isobath northeast of Cape Hatteras. In early summer 1995, a humpback was entangled and found dead in a pelagic drift gillnet on southwestern Georges Bank. Additional reports of mortality and serious injury, as well as description of total human impacts, are contained in records maintained by NMFS. A number of these records (11 entanglements involving lobster pot/trap gear) from the 1990-1994 period were the basis used to reclassify the lobster fishery (62 FR 33, Jan. 2, 1997). Large whale entanglements are rarely observed during fisheries sampling operations. However, during 2008, 3 humpback whales were observed as incidental bycatch: 2 in gillnet gear (1 no serious injury; 1 undetermined) and 1 in a purse seine (released alive) and in 2011 a humpback was caught on an observed gillnet trip (disentangled and released free of gear; Cole and Henry *in prep*.). A recent review (Cassoff ~~et al~~*et al*. 2011) describes in detail the types of injuries that baleen whales, including humpbacks, suffer as a result of entanglement in fishing gear.

For this report, the records of dead, injured, and/or entangled humpbacks (found either stranded or at sea) for the period ~~2006~~ 2007 through ~~2010~~ 2011 were reviewed. Entanglements accounted for ~~nine~~ eight mortalities and ~~20~~ 3~~7~~6.5 serious injuries (prorated value)~~ and were a secondary cause of mortality for another animal~~. With no evidence to the contrary, all events were assumed to involve members of the Gulf of Maine stock. While these records are not statistically quantifiable in the same way as observer fishery records, they provide some indication of the minimum frequency of entanglements. Specifically to this stock, if the calculations of Robbins (2011 and 2012) are reasonable then the 3% mortality due to entanglement that they calculate equates to a minimum average rate of 25, which is nearly 10 times PBR.

~~Of the 27 reported fisheries entanglements resulting in serious injury or mortality from U.S. waters during this 5-year time period, 17 were reported before the Atlantic Large Whale Take Reduction Plan's sinking groundline rule went into effect in April 2009, and 10 were reported after enactment of the rule. Statistical analysis of the effectiveness of this rule is underway.~~

Table 2. Confirmed human-caused mortality records of Humpback Whales (*Megaptera novaeangliae*) where the cause was assigned as either an entanglement (EN) or a ship strike (SS): 2007-2011 [a]

Date[b]	Fate	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]
1/27/2007	Serious Injury	-	4 nm E of Beach Haven, NJ	EN	1	XU	NR
4/29/2007	Unknown	-	50 yards offshore of Gallery Row Rd. Nags Head, N.C.	EN	0.75	XU	NR
5/10/2007	Mortality	-	off Wachapreague, VA	SS	1	US	-
5/13/2007	Mortality	-	Rockport, MA	SS	1	US	-
6/23/2007	Serious Injury	Egg Toss	Wildcat Knoll, ~24 nm NNE of Race Point, MA	EN	1	XU	NR
6/24/2007	Mortality	Tofu	Stellwagen Bank	SS	1	US	-
9/7/2007	Unknown	-	48 nm S of Block Island, RI	EN	0.75	XU	NR
11/18/2007	Unknown	-	Less than 1/2 mi from shore; off Weekapaug Beach, RI.	EN	0.75	US	NR
12/21/2007	Mortality	-	Ocean Sands, Corolla, NC	EN	1	XU	NR
1/6/2008	Serious Injury	-	20 nm S of Cape Lookout, NC	EN	1	XU	NR
1/10/2008	Unknown	-	~ 80 mi NE of Wilmington, NC	EN	0.75	US	H/MF
5/7/2008	Unknown	Brillo	southwest corner of Stellwagen Bank	EN	0.75	XU	NR
5/30/2008	Mortality	-	Georges Bank	EN	1	XU	NR
6/9/2008	Mortality	-	Georges Bank	EN	1	US	PT
7/8/2008	Serious Injury	Estuary	.5 mi outside of Nauset Inlet, Cape Cod, MA	EN	1	US	GU

7/13/2008	Unknown	-	off Monomoy Point, Cape Cod, MA	EN	0.75	XU	NR
8/13/2008	Serious Injury	-	~125 mi due E of NJ coast	EN	1	XU	NR
8/21/2008	Serious Injury	-	13 nm E of Chatham, MA	EN	1	XU	NR
9/20/2008	Unknown	Cranny	4.75 nm WNW Brier Island, NS	EN	0.75	XC	NR
11/4/2008	Mortality	-	Assateague Island, MD	SS	1	US	-
11/8/2008	Unknown	-	Nova Scotia	EN	0.75	XC	NR
2/8/2009	Mortality	-	Cape Fear, NC	EN	1	XU	NP
2/16/2009	Mortality	-	Nags Head, NC	EN	1	XU	NP
2/25/2009	Serious Injury	-	10 mi N of the tip of NJ	EN	1	US	NR
4/9/2009	Unknown	-	Stellwagen Bank	EN	0.75	XU	NR
4/11/2009	Unknown	-	off Northern Stellwagen Bank	EN	0.75	XU	NR
5/23/2009	Unknown	-	SW Stellwagen	EN	0.75	XU	NR
6/9/2009	Serious Injury	Inukshuk	Southern Stellwagen Bank	EN	1	US	NR
9/12/2009	Unknown	2008 Calf of Touchdown	near White Island, NS	EN	0.75	CN	WE
9/16/2009	Unknown	-	Outside Halifax Harbor	EN	0.75	XC	NR
11/20/2009	Unknown	-	Onslow Bay, NC	EN	0.75	XU	NR
12/9/2009	Serious Injury	-	~20 mi E of Jacksonville, FL	EN	1	CN	GN
3/7/2010	Serious Injury	-	18.5 mi E of Ponte Verde, FL	EN	1	XU	NR
3/13/2010	Mortality	-	Ocean City, MD	SS	1	US	-
5/5/2010	Serious Injury	-	North Hampton, VA, Chesapeake Bay	EN	1	XU	NR
5/8/2010	Mortality	-	Narragansett, RI	EN	1	CN	GN

5/15/2010	Serious Injury	-	Hatteras Inlet Sandbar, NC	EN	1	XU	NP
5/18/2010	Serious Injury	Pinch	E of Stellwagen Bank	EN	1	XU	NR
5/28/2010	Mortality	-	Edgartown, MA	EN	1	XU	GU
6/10/2010	Mortality	-	Jones Beach State Park, NY	SS	1	US	-
7/4/2010	Mortality	-	off Assateague, MD	SS	1	US	-
7/26/2010	Unknown	-	14 mi E of Chatham Harbor Inlet, MA	EN	0.75	XU	NR
8/13/2010	Serious Injury	-	E of Nauset Inlet, MA	EN	1	US	PT
8/20/2010	Serious Injury	Chili	SE corner of Stellwagen Bank	EN	1	XU	NR
9/10/2010	Unknown	-	4 miles from White Head Island, Grand Manan	EN	0.75	XC	NR
10/2/2010	Unknown	-	4 nm NE of Race Point, MA	EN	0.75	XU	NR
11/27/2010	Mortality	-	Bay of Fundy	EN	1	XC	NR
12/23/2010	Serious Injury	-	S of Port Everglades Inlet, FL	EN	1	XU	NP
1/7/2011	Serious Injury	-	Oregon Inlet, Outer Banks	EN	1	US	NR
2/1/2011	Serious Injury	EKG	24 m S of Bar Harbor	EN	1	US	NR
3/7/2011	Serious Injury	-	Thorofare Bay, Core Sound, NC	SS	1	US	-
4/11/2011	Unknown	-	Off Halibut Point, Rockport, MA	EN	0.75	XU	NR
4/15/2011	Unknown	-	1/2 mile off NE Little Island Park Pier	EN	0.75	US	GN
5/5/2011	Mortality	-	Little Compton, RI	SS	1	US	-

5/27/2011	Mortality	-	Barnegat Inlet, NJ	SS	1	US	-
5/30/2011	Unknown	-	Offshore Nauset Beach, Orleans MA	EN	0.75	XU	NR
7/2/2011	Serious Injury	-	Off Race Point, Cape Cod	EN	1	XU	NP
7/9/2011	Unknown	-	3 mi S Monomoy Island	EN	0.75	XU	NR
7/10/2011	Unknown	-	7 mi E of Monomoy Island	EN	0.75	XU	NR
7/21/2011	Unknown	-	Oregon Inlet, Rodanthe, NC	EN	0.75	XU	NR
10/10/2011	Serious Injury	Clutter	5.3 nm NE of Grand Manan, BOF	EN	1	XC	NR
11/8/2011	Serious Injury	Dyad	32 nm E of Nantucket, MA	EN	0.75	XU	MF
Five-year totals		Shipstrike (US/CN/XU/XC)			2.00 (2.00/ 0.00/ 0.00/ 0.00)		
		Entanglement (US/CN/XU/XC)			9.20 (1.85/ 0.55/ 5.80/ 1.00)		

a. For more details on events please see Cole and Henry *in press* and Henry *et al. in press.*

b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)

d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir

~~Table 2. Confirmed human-caused mortality and serious injury records of North Atlantic humpback whales, January 2006 – December 2010. All records were assumed to involve members of the Gulf of Maine humpback whale stock unless a whale was confirmed to be a member of another stock.~~

~~Date[a]~~	~~Report~~	~~Age, Sex, ID,~~	~~Location[a]~~	~~Assigned Cause: P=primary, S=secondary~~		~~Notes/Observations~~
-	~~Type~~	~~Length~~	-	-		-
-	-	-	-	-	-	-
-	-	-	-	~~Ship strike~~	~~Entanglement/~~	-
-	-	-	-	-	~~Fishery interaction~~	-

~~1/9/2006~~	~~mortality~~	~~Adult Female #8667 14.0m~~	~~off Charleston, SC~~	~~P~~	~~-~~	~~Extensive muscle hemorrhaging; rib fractures; dislocated flipper on left side of animal~~
~~3/17/2006~~	~~mortality~~	~~Juvenile Female 10.0m~~	~~Virginia Beach, VA~~	~~P~~	~~-~~	~~Crushed cranium and fractured mandible; hemorrhaging associated with fractures; ventral lacerations consistent with propeller wounds~~
~~3/25/2006~~	~~serious injury~~	~~Juvenile sex unknown 8m (est)~~	~~Flagler Beach, FL (confirmed Canadian gear)~~[b]	~~-~~	~~P~~	~~Heavy cyamid load; emaciated; spinal deformity that may or may not have been caused by the entanglement; gear recovered included line and buoys and was identified as Canadian lobster pot gear~~
~~8/6/2006~~	~~serious injury~~	~~age & sex unknown~~	~~Georges Bank~~	~~-~~	~~P~~	~~Multiple constricting wraps around head; line cutting into upper lip; wraps around both flippers; no gear recovered~~
~~8/23/2006~~	~~serious injury~~	~~age & sex unknown 12m (est)~~	~~Great South Channel~~	~~-~~	~~P~~	~~Flukes necrotic and nearly severed as a result of entanglement; pale skin and emaciated; gear recovered included heavy line and wire trap~~
~~09/06/06~~[e]	~~mortality~~	~~age & sex unknown~~	~~East of Cape Cod, MA~~	~~-~~	~~P~~	~~Whale entangled through mouth, continuing back to multiple wraps around peduncle; no gear recovered~~

~~09/27/06[d]~~	~~serious injury~~	~~age & sex unknown~~	~~off Cape May, NJ~~		~~P~~	~~Line anchored in mouthline & crosses over back; extent of entanglement unknown but animal is emaciated~~
~~10/15/2006~~	~~mortality~~	~~Juvenile Female 10.1m~~	~~off Fenwick Island, DE~~	~~P~~	~~S~~	~~Large laceration, penetrating through the bone, across rostrum with accompanying fractures; no gear, but marks around right flipper consistent with entanglement; subdermal hemorrhaging and bone trauma at entanglement point~~
~~1/27/2007~~	~~serious injury~~	~~age & sex unknown~~	~~off Beach Haven, NJ~~	~~-~~	~~P~~	~~Body wrap likely to become constricting; random cyamid patches; thin body condition; probable flipper wraps; no gear recovered~~
~~5/10/2007~~	~~mortality~~	~~Adult Female 12.5m~~	~~off Wachapreague, VA~~	~~P~~	~~-~~	~~Cranium shattered, hemorrhaging on left lateral side midway between flippers & fluke~~
~~5/13/2007~~	~~mortality~~	~~Juvenile Male 9.3m~~	~~Rockport, MA~~	~~P~~	~~-~~	~~Areas of hemorrhaging indicate major blunt trauma to chest, neck, & head~~
~~6/23/2007~~	~~serious injury~~	~~age unknown Male "Egg Toss"~~	~~Wildcat Knoll~~	~~-~~	~~P~~	~~Body wrap of gear imbedded; no gear recovered~~

~~6/24/2007~~	~~mortality~~	~~Juvenile Female "Tofu" 9.9m~~	~~Stellwagen Bank~~	~~P~~	~~-~~	~~Subdermal hemorrhaging involving blubber, fascia, & muscle extending from/around the insertion of the right flipper ventrally to the axilla~~
~~12/21/2007~~	~~mortality~~	~~age unknown Male 9.4m~~	~~Ocean Sands, Corolla, NC~~	~~-~~	~~P~~	~~Documented wrapped in gear, gear removed without permission prior to necropsy; external lesions at flukes, flippers, mouth, dorsal fin, dorsal keel, & ventral pleats consistent with gillnet entanglement; emaciated; no gear recovered~~
~~1/6/2008~~	~~serious injury~~	~~age & sex unknown 10m (est)~~	~~off Cape Lookout, NC~~	~~-~~	~~P~~	~~Constricting line cutting into right flipper in several places; heavy cyamid load; emaciated; no gear recovered~~
~~5/30/2008~~	~~mortality~~	~~age & sex unknown~~	~~Georges Bank~~	~~-~~	~~P~~	~~Constricting body wraps, one wrap under lower jaw; open wound on right flipper; no gear recovered~~
~~6/9/2008~~	~~mortality~~	~~age & sex unknown~~	~~Georges Bank~~	~~-~~	~~P~~	~~Constricting body wrap; gear analysis pending~~
~~7/8/2008~~	~~serious injury~~	~~Adult Female "Estuary"~~	~~off Nauset, MA~~	~~-~~	~~P~~	~~Cuts were made, but no gear was removed; emaciated; moderate cyamid coverage; deep wounds in fluke blades from gear; hunched over position maintained after cuts were made to the gear; gear analysis pending~~

~~8/13/2008~~	~~serious injury~~	~~age & sex unknown 10m (est)~~	~~off NJ~~	~~-~~	~~P~~	~~Partial disentanglement; emaciated; lethargic; heavy cyamid load; gear analysis pending~~
~~8/21/2008~~	~~serious injury~~	~~age & sex unknown~~	~~off Chatham, MA~~	~~-~~	~~P~~	~~Evidence of decline in health; no gear recovered~~
~~11/4/2008~~	~~mortality~~	~~Juvenile Male 10.1m~~	~~Assateague Island, MD~~	~~P~~	~~-~~	~~Cranial fractures with associated hemorrhaging~~
~~2/8/2009~~	~~mortality~~	~~age unknown Male 9.7m~~	~~Cape Fear, NC~~	~~-~~	~~P~~	~~Evidence of entanglement at mouthline, peduncle, and flipper with associated hemorrhaging; emaciated; no gear present~~
~~2/16/2009~~	~~mortality~~	~~Juvenile Male 10.0m~~	~~Nags Head, NC~~	~~-~~	~~P~~	~~Evidence of entanglement involving anchoring or heavily weighted gear with associated hemorrhaging; no gear present~~
~~2/25/2009~~	~~serious injury~~	~~Juvenile sex unknown~~	~~off Sandy Hook, NJ~~	~~-~~	~~P~~	~~Disentangled from anchoring gear; maintained hunched body position post-disentanglement; no gear recovered~~
~~6/9/2009~~	~~serious injury~~	~~age & sex unknown~~	~~Stellwagen Bank~~	~~-~~	~~P~~	~~Constricting body wrap just forward of the flippers; no gear recovered~~
~~12/9/2009~~	~~serious injury~~	~~age & sex unknown~~	~~off Jacksonville, FL (confirmed Canadian gear)~~[b]	~~-~~	~~P~~	~~Disentangled; evidence of health decline; Canadian gillnet gear~~
~~3/7/2010~~	~~serious injury~~	~~age & sex unknown~~	~~off Ponte Vedre, FL~~	~~-~~	~~P~~	~~Constricting body & flipper wraps; evidence of severe health decline~~

~~3/13/2010~~	~~mortality~~	~~Juvenile Female 9.1m~~	~~Ocean City, MD~~	~~P~~	~~-~~	~~Skull fractures with associated hemorrhaging~~
~~5/5/2010~~	~~serious injury~~	~~Juvenile sex unknown~~	~~Chesapeake Bay~~	~~-~~	~~P~~	~~Gear likely to become constricting as animal grows; evidence of health decline; no gear recovered~~
~~5/8/2010~~	~~mortality~~	~~Adult Female 9.8m~~	~~Narragansett, RI~~	~~-~~	~~P~~	~~Evidence of constricting gear with associated hemorrhaging; fluid filled lungs; gear analysis pending~~
~~5/15/2010~~	~~serious injury~~	~~Juvenile Male 8.8m~~	~~off Hatteras Inlet, NC~~	~~-~~	~~P~~	~~Live stranded; euthanized; necrotic infected injuries consistent with entanglement; no gear present~~
~~5/18/2010~~	~~serious injury~~	~~Adult sex unknown "Pinch"~~	~~Stellwagen Bank~~	~~-~~	~~P~~	~~Constricting body wrap; no gear recovered~~
~~5/28/2010~~	~~mortality~~	~~Adult Female 11.2m~~	~~Edgartown, MA~~	~~-~~	~~P~~	~~Evidence of entanglement with associated bruising & edema; gear analysis pending~~
~~6/10/2010~~	~~mortality~~	~~Juvenile Male 9.6m~~	~~Jones Beach State Park, NY~~	~~P~~	~~-~~	~~Extensive hemorrhage & edema on right dorsal lateral surface~~
~~7/4/2010~~	~~mortality~~	~~Juvenile Female 8.7m~~	~~off Assateague, MD~~	~~P~~	~~-~~	~~Extensive hemorrhage & edema to left lateral area~~
~~8/13/2010~~	~~serious injury~~	~~age & sex unknown~~	~~off Nauset, MA~~	~~-~~	~~P~~	~~Head wrap likely to become constricting; gear analysis pending~~
~~8/20/2010~~	~~serious injury~~	~~Juvenile sex unknown 2008 calf of "Trident"~~	~~Stellwagen Bank~~	~~-~~	~~P~~	~~Embedded peduncle wrap; evidence of health decline; no gear recovered~~

~~11/27/2010~~	~~mortality~~	~~Juvenile Male 7.5m (est)~~	~~Bay of Fundy, Canada~~	~~-~~	~~P~~	~~Evidence of constricting wraps on fluke, peduncle, and flipper; no gear recovered~~
~~12/23/2010~~	~~serious injury~~	~~age & sex unknown~~	~~off Port Everglades Inlet, FL~~	~~-~~	~~P~~	~~Evidence of entanglement & severe health decline; no gear present~~

~~a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.~~

~~b. Gear origin not included in previous reports.~~

~~c. Record was added after review of carcasses sighted on 08/20/06 and 09/06/06. Previous reports stated these were the same animal. Recent review could not confirm the resight; therefore they are now being treated as two separate events. There was inconclusive evidence with regard to the carcass on 08/20/06 to determine mortality caused by entanglement.~~

~~d. Record was added after review of event; not included in previous reports~~

Other Mortality

Between November 1987 and January 1988, at least 14 humpback whales died after consuming Atlantic mackerel containing a dinoflagellate saxitoxin (Geraci *et al.* 1989). The whales subsequently stranded or were recovered in the vicinity of Cape Cod Bay and Nantucket Sound, and it is highly likely that other unrecorded mortalities occurred during this event. During the first six months of 1990, seven dead juvenile (7.6 to 9.1 m long) humpback whales stranded between North Carolina and New Jersey. The significance of these strandings is unknown.

In July 2003, an Unusual Mortality Event (UME) was invoked in offshore waters when an estimated minimum of 12-15 humpback whales died in the vicinity of the Northeast Peak of Georges Bank. Preliminary tests of samples taken from some of these whales were positive for domoic acid at low levels, but it is currently unknown what levels would affect the whales and therefore no definitive conclusions can yet be drawn regarding the cause of this event or its effect on the status of the Gulf of Maine humpback whale population. Seven humpback whales were considered part of a large whale UME in New England in 2005. Twenty-one dead humpback whales found between 10 July and 31 December 2006 triggered a humpback whale UME declaration. Causes of these UME events have not been determined.

STATUS OF STOCK

NMFS recently concluded a global humpback whale status review, the report of which is ~~expected to be completed in 2012~~being finalized. NMFS will include the relevant results of this review in the SARs when they are available. The status of the North Atlantic humpback whale population was the topic of an International Whaling Commission Comprehensive Assessment in June 2001, and again in May 2002. These meetings conducted a detailed review of all aspects of the population and made recommendations for further research (IWC 2002). Although recent estimates of abundance indicate continued population growth, the size of the humpback whale stock may be below OSP in the U.S. Atlantic EEZ. A Recovery Plan was published and is in effect (NMFS 1991). There are insufficient data to reliably determine current population trends for humpback whales in the North Atlantic overall. The average annual rate of population increase was estimated at 3.1% (SE=0.005, Stevick *et al.* 2003). An analysis of demographic parameters for the Gulf of Maine (Clapham *et al.* 2003) suggested a lower rate of increase than the 6.5% reported by Barlow and Clapham (1997), but results may have been confounded by distribution shifts. The total level of U.S. fishery-caused mortality and serious injury is unknown, but reported levels are more than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant or approaching zero mortality and serious injury rate. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the North Atlantic humpback whale is an endangered species.

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FIN WHALE (*Balaenoptera physalus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Scientific Committee of the International Whaling Commission (IWC) has proposed stock boundaries for North Atlantic fin whales. Fin whales off the eastern United States, Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock under the present IWC scheme (Donovan 1991). However, the stock identity of North Atlantic fin whales has received relatively little attention, and whether the current stock boundaries define biologically isolated units has long been uncertain. The existence of a subpopulation structure was suggested by local depletions that resulted from commercial overharvesting (Mizroch *et al.* 1984).

A genetic study conducted by Bérubé *et al.* (1998) using both mitochondrial and nuclear DNA provided strong support for an earlier population model proposed by Kellogg (1929) and others. This postulates the existence of several subpopulations of fin whales in the North Atlantic and Mediterranean with limited gene flow among them. Bérubé *et al.* (1998) also proposed that the North Atlantic population showed recent divergence due to climatic changes (i.e., postglacial expansion), as well as substructuring over even relatively short distances. The genetic data are consistent with the idea that different subpopulations use the same feeding ground, a hypothesis that was also originally proposed by Kellogg (1929).

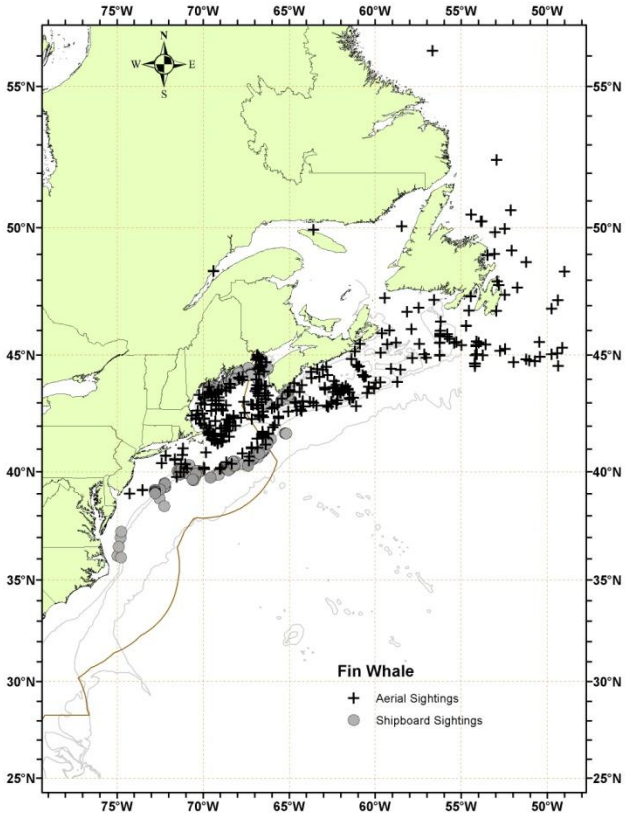

Figure 1. *Distribution of fin whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010 and 2011 and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Fin whales are common in waters of the U. S. Atlantic Exclusive Economic Zone (EEZ), principally from Cape Hatteras northward (Figure 1). Fin whales accounted for 46% of the large whales and 24% of all cetaceans sighted over the continental shelf during aerial surveys (CETAP 1982) between Cape Hatteras and Nova Scotia during 1978–82. While much remains unknown, the magnitude of the ecological role of the fin whale is impressive. In this region fin whales are the dominant large cetacean species during all seasons, having the largest standing stock, the largest food requirements, and therefore the largest influence on ecosystem processes of any cetacean species (Hain *et al.* 1992; Kenney *et al.* 1997).

New England waters represent a major feeding ground for fin whales. There is evidence of site fidelity by females, and perhaps some segregation by sexual, maturational or reproductive class in the feeding area (Agler *et al.* 1993). Seipt *et al.* (1990) reported that 49% of fin whales sighted on the Massachusetts Bay area feeding grounds were resighted within the same year, and 45% were resighted in multiple years. The authors suggested that fin whales on these grounds exhibited patterns of seasonal occurrence and annual return that in some respects were similar to those shown for humpback whales. This was reinforced by Clapham and Seipt (1991), who showed

maternally-directed site fidelity for fin whales in the Gulf of Maine.

Hain *et al.* (1992), based on an analysis of neonate stranding data, suggested that calving takes place during October to January in latitudes of the U.S. mid-Atlantic region; however, it is unknown where calving, mating, and wintering occurs for most of the population. Results from the Navy's SOSUS program (Clark 1995) indicate a substantial deep-ocean distribution of fin whales. It is likely that fin whales occurring in the U.S. Atlantic EEZ undergo migrations into Canadian waters, open-ocean areas, and perhaps even subtropical or tropical regions. However, the popular notion that entire fin whale populations make distinct annual migrations like some other mysticetes has questionable support in the data; in the North Pacific, year-round monitoring of fin whale calls found no evidence for large-scale migratory movements (Watkins *et al.* 2000).

POPULATION SIZE

The best abundance estimate available for the western North Atlantic fin whale stock is 3,522 (CV=0.27). This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July–August 2007 and is considered best because it covered more of the fin whale range than the other surveys.

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates. As recommended in the GAMMS II Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

~~An abundance estimate of 1,925 (CV=0.55) fin whales was derived from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of trackline in waters north of Maryland (38ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle back line transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.~~

An abundance of 2,269 (CV=0.37) fin whales was estimated from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; D. Palka, NEFSC, Woods Hole, MA, ~~-~~pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 3,522 ~~-~~(CV=0.27; J. Lawson, DFO, pers. comm.) fin whales was generated from the TNASS in July–August 2007. This aerial survey covered the area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast~~.~~ (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling~~ (MRDS)~~, and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (~~2007~~1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 1,595 (CV=0.33) fin whales was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a ~~two simultaneous team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the multiple covariate distance sampling (MCDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimates of fin whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The

percentage used is the ratio of positively identified fin whales to the total number of positively identified fin whales and positively identified sei whales; the CV of the abundance estimate includes the variance of the estimated fraction. ~~An abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~

~~A 2011 abundance survey was also conducted in the southern U.S. waters.~~ An abundance estimate of 23 (CV=0.87) fin whales was generated from a shipboard survey conducted ~~conducted~~ concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).~~during June–August 2011 between central Florida and Virginia. The survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of survey effort were accomplished with 290 cetacean sightings. The majority of sightings occurred along the continental shelf-break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).~~

Table 1. Summary of recent abundance estimates for western North Atlantic fin whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-July 2004~~	~~Gulf of Maine to lower Bay of Fundy~~	~~1,925~~	~~0.55~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	2,269	0.37
July-Aug 2007	N. Labrador to Scotian Shelf	3,522	0.27
Jun-Aug 2011	~~North Carolina~~Central Virginia to lower Bay of Fundy	1,595	0.33
Jun-Aug 2011	Central Florida to Central Virginia	23	0.76
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	1,618	0.33

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for fin whales is 3,522 (CV=0.27). The minimum population estimate for the western North Atlantic fin whale is 2,817.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the

power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~There are insufficient data to determine population trends for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Based on photographically identified fin whales, Agler *et al.* (1993) estimated that the gross annual reproduction rate was 8%, with a mean calving interval of 2.7 years.

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 2,817. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.10 because the fin whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic fin whale is 5.6.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period ~~2006~~ 2007 through ~~2010~~2011, the minimum annual rate of human-caused mortality and serious injury to fin whales was ~~2.0~~3.7 per year~~ (~~. ~~U.S. waters, 1.83.0; Canadian waters, 0.27)~~. This value includes incidental fishery interaction records, ~~0.8~~2.3~~ (U.S. waters, 0.61.6; Canadian waters, 0.27)~~; and records of vessel collisions, 1.~~2~~4 ~~(U.S. waters, 1.24; Canadian waters, 0)~~(Table 2; Henry *et al.* ~~2012~~*in press*, Cole and Henry *in prep.*).~~-~~ Annual rates calculated from detected mortalities should not be considered an unbiased representation of human-caused mortality, but they represent a ~~definitive~~ lower bound. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). ~~-~~NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". ~~—~~Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery-Related Serious Injury and Mortality

No confirmed fishery-related mortalities or serious injuries of fin whales have been reported in the NMFS Sea Sampling bycatch database. A review of the records of stranded, floating or injured fin whales for the period ~~2006~~ 2007 through ~~2010~~ 2011 on file at NMFS found ~~two~~ five records with substantial evidence of fishery interactions causing mortality~~, and two records resulting in serious injury~~ (~~Table 2~~Henry ~~et al~~*et al*. *in press*~~),~~). Serious injury ~~dcalculated~~ determination of non-fatal fishery interaction records yielded a value of 6.5 (Cole and Henry, *in prep*.). The resultant ~~which results in a~~estimated minimum annual rate of serious injury and mortality ~~of 0.82.3 fin whales~~ from fishery interactions for this fin whale stock is 2.3. These records are not statistically quantifiable in the same way as the observer fishery records, and they almost surely undercount entanglements for the stock.

Table 2. Confirmed human-caused mortality records of Fin Whales (*Balaenoptera physalus*) where the cause was assigned as either an entanglement (EN) or a ship strike (SS): 2007-2011 [a]

Date[b]	Fate	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]
3/25/2007	Mortality	-	Norfolk, VA	SS	1	US	-
5/24/2007	Mortality	-	Newark Bay, NJ	SS	1	US	-
6/25/2007	Serious Injury	-	Great South Channel, 33 nm ESE of Chatham, MA; 67 nm from Provincetown, MA	EN	1	XU	NR
7/21/2007	Unknown	-	16 nm E of Cape Neddick, ME	EN	0.75	XU	NR
8/11/2007	Mortality	-	Cabot Strait, NS	EN	1	CN	NR
9/23/2007	Unknown	-	3.5 nm S of Boone Island, ME; 8 nm SE of York, ME	EN	0.75	XU	NR
9/26/2007	Mortality	-	off Marthas Vineyard, MA	EN	1	US	NR

6/8/2008	Unknown	-	12 nm ENE Mount Desert Rock, ME	EN	0.75	XU	NR
7/2/2008	Mortality	-	Barnegat Inlet, NJ	SS	1	US	-
4/27/2009	Unknown	-	24 nm E of Cape Neddick, ME	EN	0.75	XU	NR
9/9/2009	Unknown	-	Between Campobello and Wolves Island, CAN	EN	0.75	XC	NR
10/1/2009	Mortality	-	Port Elizabeth, NJ	SS	1	US	-
10/9/2009	Unknown	-	N of Long Island, Nova Scotia, BOF	EN	0.75	XC	GU
3/18/2010	Mortality	-	off Bethany Beach, DE	SS	1	US	-
9/3/2010	Mortality	-	Cape Henlopen State Park, DE	SS	1	US	-
1/1/2011	Mortality	-	off Portland, ME	EN	1	XU	NP
6/5/2011	Mortality	-	off Long Branch, NJ	SS	1	US	-

7/2/2011	Serious Injury	F100	Between Anticosti Island and the North Shore, Gulf of St. Lawrence	EN	1	CN	NR
7/24/2011	Mortality	-	Cheticamp, NS	EN	1	CN	NP
9/21/2011	Mortality	-	off Atlantic City, NJ	EN	1	US	NP
Five-year totals		Shipstrike (US/CN/XU/XC)			1.40 (1.40/ 0.00/ 0.00/ 0.00)		
		Entanglement (US/CN/XU/XC)			2.30 (0.40/ 0.60/ 1.00/ 0.30)		

a. For more details on events please see Cole and Henry *in press* and Henry *et al. in press.*

b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)

d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir

~~Table 2. Confirmed human-caused mortality records of Western North Atlantic fin whales (*Balaenoptera physalus*), 2007–2011.~~

- ~~Date[a]~~	- ~~Report~~	- ~~Age, Sex,~~	- ~~Location[a]~~	- ~~Assigned Cause: P=primary, S=secondary~~		- ~~Notes/Observations~~
-	~~Type~~	~~Length~~	-	-		-
-	-	-	-	-	-	-
-	-	-	-	~~Vessel strike~~	~~Entanglement/~~	-
-	-	-	-	-	~~Fishery interaction~~	-

~~3/25/2007~~	~~mortality~~	~~age unknown Female 18.0m~~	~~Norfolk, VA~~	~~P~~	~~-~~	~~Extensive fracturing of ribs, skull, and vertebrae w/ associated hemorrhage & edema~~
~~5/24/2007~~	~~mortality~~	~~age unknown Male~~	~~Newark Bay, NJ~~	~~P~~	~~-~~	~~Hemorrhage (epaxial muscle, diaphragm, pleural lining) and multiple fractures of the ribs, vertebrae, & sternum and the trailing tissue of the animal was marked by propeller cuts~~
~~8/11/2007~~	~~mortality~~	~~age & sex unknown~~	~~Cabot Strait, NS~~	~~-~~	~~P~~	~~Constricting wrap around body, between the head and flippers; no gear recovered~~
~~9/26/2007~~	~~mortality~~	~~Juvenile Male 13m (est)~~	~~off Martha's Vineyard, MA~~	~~-~~	~~P~~	~~Freshly dead, scavenged carcass with gear present; evidence of multiple body wraps with associated hemorrhaging; no gear recovered~~
~~7/2/2008~~	~~mortality~~	~~age unknown Male 14.8m~~	~~Barnegat Inlet, NJ~~	~~P~~	~~-~~	~~Vertebral fractures with associated hemorrhaging; hemorrhaging around ball joint of right flipper~~
~~10/1/2009~~	~~mortality~~	~~age & sex unknown 13.7m (est)~~[b]	~~Port Elizabeth, NJ~~	~~P~~	~~-~~	~~Fresh carcass with broken flipper, hematomas, and abrasions~~
~~3/18/2010~~	~~mortality~~	~~Adult Female 18.6m~~	~~off Bethany Beach, DE~~	~~P~~	~~-~~	~~Fractured skull w/ associated hemorrhaging; abrasion mid-dorsal consistent w/ being folded over the bow of a ship~~
~~9/3/2010~~	~~mortality~~	~~Juvenile Male 9.5m~~	~~Cape Henlopen State Park, DE~~	~~P~~	~~-~~	~~Large laceration & vertebral fractures with associated hemorrhaging~~

1/1/2011	mortality	age & sex unknown	off Portland, ME	-	P	Fresh carcass with evidence of constricting gear; no gear present
6/5/2011	mortality	Juvenile Male 14.7m	off Long Branch, NJ	P	-	Extensive hemorrhage and soft dissue damage to the dorsal and right lateral thoraic region
7/24/2011	mortality	Juvenile Male 15.2m (est)	Cheticamp, NS	-	P	Fresh carcass with evidence of extensive entanglement; no gear present
9/21/2011	mortality	Juvenile sex unknown 12.2m (est)	off Atlantic City, NJ	-	P	Fresh carcass with evidence of extensive entanglement; no gear present
-	-	-	-	Vessel strike	Entanglement/ Fishery Interaction	-
5 year totals	US waters	-	Mortality	7	2	-
-	Canadian waters		Mortality	0	2	-
-	Unknown waters		Mortality	0	1	-

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

b. Information not included in previous reports.

Table 2. Confirmed human-caused mortality and serious injury records of Western North Atlantic fin whales (*Balaenoptera physalus*), 2006 – 2010.

Date[a]	Report	Age, Sex,	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
-	Type	Length	-	-		-
-	-	-	-	-	-	-
-	-	-	-	Ship strike	Entanglement/	-
-	-	-	-	-	Fishery interaction	-

~~9/17/2006~~	~~serious injury~~	~~age & sex unknown 18m (est)~~	~~off Mt. Desert Rock, ME~~	~~-~~	~~P~~	~~Pale skin overall; cyamid load at point of attachment; emaciated; no gear recovered~~
~~3/25/2007~~	~~mortality~~	~~age unknown Female 18.0m~~	~~Norfolk, VA~~	~~P~~	~~-~~	~~Extensive fracturing of ribs, skull, and vertebrae w/ associated hemorrhage & edema~~
~~5/24/2007~~	~~mortality~~	~~age unknown Male~~	~~Newark Bay, NJ~~	~~P~~	~~-~~	~~Hemorrhage (epaxial muscle, diaphragm, pleural lining) and multiple fractures of the ribs, vertebrae, & sternum and the trailing tissue of the animal was marked by propeller cuts~~
~~6/25/2007~~	~~serious injury~~	~~age & sex unknown~~	~~Great South Channel~~	~~-~~	~~P~~	~~Wrap on tail assoc w/ cyamid load; flippers & mouth involved; extremely emaciated; lethargic; no gear recovered~~
~~8/11/2007~~	~~mortality~~	~~age & sex unknown~~	~~Cabot Strait, NS~~	~~-~~	~~P~~	~~Constricting wrap around body, between the head and flippers; no gear recovered~~
~~9/26/2007~~	~~mortality~~	~~Juvenile Male 13m (est)~~	~~off Martha's Vineyard, MA~~	~~-~~	~~P~~	~~Freshly dead, scavenged carcass with gear present; evidence of multiple body wraps with associated hemorrhaging; no gear recovered~~
~~7/2/2008~~	~~mortality~~	~~age unknown Male 14.8m~~	~~Barnegat Inlet, NJ~~	~~P~~	~~-~~	~~Vertebral fractures with associated hemorrhaging; hemorrhaging around ball joint of right flipper~~

~~10/1/2009~~	~~mortality~~	~~age & sex unknown~~	~~Port Elizabeth, NJ~~	~~P~~	~~-~~	~~Fresh carcass with broken flipper, hematomas, and abrasions~~
~~3/18/2010~~	~~mortality~~	~~Adult Female 18.6m~~	~~off Bethany Beach, DE~~	~~P~~	~~-~~	~~Fractured skull w/ associated hemorrhaging; abrasion mid-dorsal consistent w/ being folded over the bow of a ship~~
~~9/3/2010~~	~~mortality~~	~~Juvenile Male 9.5m~~	~~Cape Henlopen State Park, DE~~	~~P~~	~~-~~	~~Large laceration & vertebral fractures with associated hemorrhaging~~
~~a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.~~						

Other Mortality

After reviewing NMFS records for ~~2006~~ 2007 through ~~2010~~2011, ~~six~~ seven were found that had sufficient information to confirm the cause of death as collisions with vessels (Table 2; Henry *et al*. ~~2012~~in press). These records constitute an annual rate of serious injury or mortality of ~~1.2~~1.4 fin whales from vessel collisions. The number of fin whales taken at three whaling stations in Canada from 1965 to 1971 totaled 3,528 whales (Mitchell 1974).

STATUS OF STOCK

This is a strategic stock because the fin whale is listed as an endangered species under the ESA. The total level of human-caused mortality and serious injury is unknown. NMFS records represent coverage of only a portion of the area surveyed for the population estimate for the stock. The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is ~~is~~ likely biased low and is still not less than 10% of the calculated PBR. Therefore entanglement rates cannot be considered insignificant and approaching the ZMRG. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine the population trend for fin whales. A final recovery plan for the fin whale was published in 2010 (NMFS 2010).

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SEI WHALE (*Balaenoptera borealis borealis*): Nova Scotia Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Mitchell and Chapman (1977) reviewed the sparse evidence on stock identity of northwest Atlantic sei whales, and suggested two stocks—a Nova Scotia stock and a Labrador Sea stock. The range of the Nova Scotia stock includes the continental shelf waters of the northeastern U.S., and extends northeastward to south of Newfoundland. The Scientific Committee of the International Whaling ~~Committee~~ Commission (IWC), while adopting these general boundaries, noted that the stock identity of sei whales (and indeed all North Atlantic whales) was a major research problem (Donovan 1991). In the absence of evidence to the contrary, the proposed IWC stock definition is provisionally adopted, and the "Nova Scotia stock" is used here as the management unit for this stock assessment. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia, thence east to longitude 42° W.

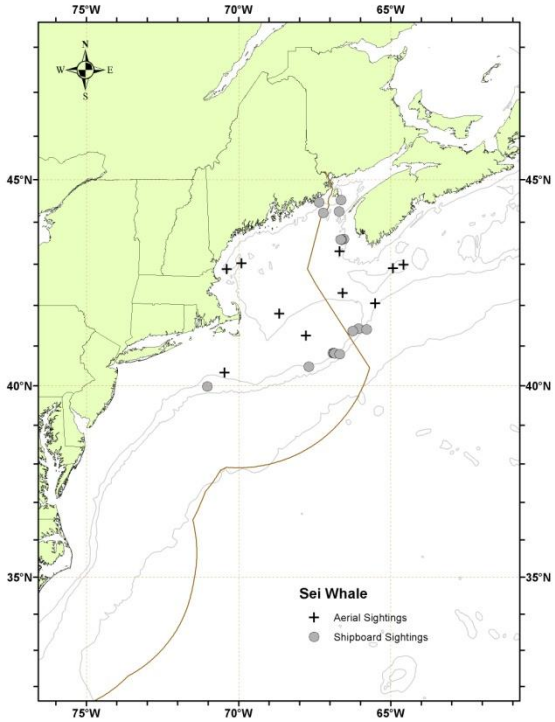

Figure 1. *Distribution of sei whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Indications are that, at least during the feeding season, a major portion of the Nova Scotia sei whale stock is centered in northerly waters, perhaps on the Scotian Shelf (Mitchell and Chapman 1977). The southern portion of the species' range during spring and summer includes the northern portions of the U.S. Atlantic Exclusive Economic Zone (EEZ)—the Gulf of Maine and Georges Bank. Spring is the period of greatest abundance in U.S. waters, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (CETAP 1982). NMFS aerial surveys from 1999 on have found concentrations of sei and right whales along the northern edge of Georges Bank in the spring. The sei whale is often found in the deeper waters characteristic of the continental shelf edge region (Hain *et al.* 1985), and NMFS aerial surveys found substantial numbers of sei whales in this region, in particular south of Nantucket, in the spring of 2001. Similarly, Mitchell (1975) reported that sei whales off Nova Scotia were often distributed closer to the 2,000-m depth contour than were fin whales.

This general offshore pattern of sei whale distribution is disrupted during episodic incursions into shallower, more inshore waters. Although known to eat fish, sei whales (like right whales) are largely planktivorous, feeding primarily on euphausiids and copepods (Flinn *et al.* 2002). A review by prey preferences by Horwood (1987) showed that in the North Atlantic sei whales seem to prefer copepods over all other prey species. In Nova Scotia sampled stomachs from captured sei whales showed a clear preference for copepods between June and October, and euphausiids were taken only in May and November (Mitchell 1975). Sei whales are reported in some years in more inshore locations, such as the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986) areas (R.D. Kenney, pers. comm.; Payne *et al.* 1990). An influx of sei whales into the southern Gulf of Maine occurred in the summer of 1986 (Schilling *et al.* 1993). Such episodes, often punctuated by years or even decades of absence from an area, have been reported for sei whales from various places worldwide (Jonsgård and Darling 1977).

Based on analysis of records from the Blandford, Nova Scotia, whaling station, where 825 sei whales were taken between 1965 and 1972, Mitchell (1975) described two "runs" of sei whales, in June-July and in September-October. He speculated that the sei whale population migrates from south of Cape Cod and along the coast of

eastern Canada in June and July, and returns on a southward migration again in September and October; however, such a migration remains unverified.

POPULATION SIZE

The summer 2011 abundance estimate of 357 (CV=0.52) is considered the best available for the Nova Scotia stock of sei whales. However, this estimate must be considered conservative because all of the known range of this stock was not surveyed, and because of uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas.

Earlier abundance estimates

Please see appendix IV for earlier abundance estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

~~An abundance estimate of 386 (CV=0.85) sei whales was derived from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of trackline in waters north of Maryland (38ºN)(Table 1; Palka 2006). There were 6,180 km of trackline within known sei whale habitat, from the 100-m depth contour on southern Georges Bank to the lower Bay of Fundy. The Scotian shelf south of Nova Scotia was not surveyed. Shipboard data were collected using the two independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.~~

An abundance estimate of 207 (CV=0.62) sei whales was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 357 (CV=0.52) sei whales was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters from north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of ~~North Carolina~~Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a ~~two-simultaneous-team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the multiple covariate distance sampling (MCDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimates of sei whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified sei whales to the total of positively identified fin whales and positively identified sei whales; the CV of the abundance estimate includes the variance of the estimated fraction. ~~In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~

Table 1. Summary of recent abundance estimates for Nova Scotia sei whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV

~~Jun-Jul 2004~~	~~Gulf of Maine to lower Bay of Fundy~~	~~386~~	~~0.85~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	207	0.62
Jun-Aug 2011	~~North Carolina~~Central Virginia to lower Bay of Fundy	357	0.52

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for the Nova Scotia stock sei whales is 357 (CV=0.52). The minimum population estimate is 236.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~A population trend analysis has not been done for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 236. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because the sei whale is listed as endangered under the Endangered Species Act (ESA). PBR for the Nova Scotia stock of the sei whale is 0.5.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period ~~2006~~ 2007 through ~~2010~~2011, the minimum annual rate of human-caused mortality and serious injury to sei whales was ~~1.2~~1.0. This value includes incidental fishery interaction records, ~~0.6~~0.4,~~-~~ and records of vessel collisions, 0.6 (Table 2; Cole and Henrt *in prep.,* Henry *et al.* ~~2012~~*in press*). Annual rates calculated from detected mortalities should not be considered an unbiased estimate of human-caused mortality, but they represent a definitive lower bound. Detections are haphazard, incomplete and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery-Related Serious Injury and Mortality

No confirmed fishery-related mortalities or serious injuries of sei whales have been reported in the NMFS Sea Sampling bycatch database. A review of the records of stranded, floating or injured sei whales for the period ~~2006~~ 2007 through ~~2010~~ 2011 on file at NMFS found ~~3~~ 2 records with substantial evidence of fishery interactions causing serious injury or mortality (Table 2), which results in an annual ~~rate of~~ serious injury and mortality rate of 0.~~6~~ 4 sei whales from fishery interactions.

Table 2. Confirmed human-caused mortality records of Sei Whales (*Balaenoptera borealis*) where the cause was assigned as either an entanglement (EN) or a ship strike (SS): 2007-2011 [a]

Date[b]	Fate	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]
5/30/2007	Mortality	-	off Deer Island, MA	SS	1	US	-
4/9/2008	Serious Injury	-	51 nm E of Chatham, MA	EN	1	XU	NR
6/29/2008	Mortality	-	Slack's Cove, NB	EN	1	CN	NP
5/19/2009	Mortality	-	off Rehobeth Beach, DE	SS	1	US	-
3/26/2011	Mortality	-	Virginia Beach, VA	SS	1	US	-
Five-year totals		Shipstrike (US/CN/XU/XC)			0.60 (0.60/ 0.00/ 0.00/ 0.00)		
		Entanglement (US/CN/XU/XC)			0.40 (0.00/ 0.20/ 0.20/ 0.00)		

a. For more details on events please see Cole and Henry *in press* and Henry *et al. in press.*

b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

c. Mortality events are counted as 1 against PBR. Serious injury events have been evaluated using NMFS guidelines (NOAA 2012)

d. CN=Canada, US=United States, XC=Unassigned 1st sight in CN, XU=Unassigned 1st sight in US

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir

~~Table 2. Confirmed human-caused mortality and serious injury records of Nova Scotian sei whales *(Balaenoptera*~~

~~*borealis*), 2006 – 2010.~~

~~Date[a]~~	~~Report Type~~	~~Age, Sex, Length~~	~~Location[a]~~	~~Assigned Cause: P=primary, S=secondary~~		~~Notes/Observations~~
~~-~~	~~-~~	~~-~~	~~-~~	~~Ship Strike~~	~~- Entanglement/ Fish interaction~~	~~-~~
~~4/17/2006~~	~~mortality~~	~~Juvenile Male 10.9m~~	~~Baltimore, MD~~	~~P~~	~~-~~	~~Brought in on bow of ship, freshly dead; massive hemorrhaging on right side; large blood clot behind head; several broken ribs~~
~~9/16/2006~~	~~serious injury~~	~~age & sex unknown~~	~~Jeffreys Ledge~~	~~-~~	~~P~~	~~Constricting wrap cutting into skin; no gear recovered~~
~~5/30/2007~~	~~mortality~~	~~Adult Female 14.4m~~	~~off Deer Island, MA~~	~~P~~	~~-~~	~~Broken left flipper, 8 vertebral processes, and 4 ribs; right flipper sheared off; lower jaw dislocated; hemorrhaging and/or edema associated with lower jaw and left flipper region~~
~~4/9/2008~~	~~serious injury~~	~~age & sex unknown~~	~~Great South Channel~~	~~-~~	~~P~~	~~Constricting wrap on fluke; skin sloughing; no gear recovered~~
~~6/29/2008~~	~~mortality~~	~~age & sex unknown 15m (est)~~	~~Slack's Cove, NB~~	~~-~~	~~P~~	~~Extensive entanglement evident; no gear present~~
~~5/19/2009~~	~~mortality~~	~~Juvenile Male 12.7 m~~	~~off Rehobeth Beach, DE~~	~~P~~	~~-~~	~~Posterior portion of skull & right mandible fractured; hemorrhaging dorsal to left pectoral~~

~~a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.~~

Other Mortality

For the period ~~2006~~ 2007 through ~~2010~~ 2011 files at NMFS included three records with substantial evidence of vessel collisions causing serious injury or mortality (Table 2), which results in an annual rate of serious injury and mortality of 0.6 sei whales from vessel collisions. ~~Previous NMFS records of human-caused sei whale mortalities include one from 17 November 1994, when a sei whale carcass was observed on the bow of a container ship as it docked in Boston, Massachusetts, and one from 2 May 2001 when the carcass of a 13-m female sei whale slid off the bow of a ship arriving in New York harbor.~~

STATUS OF STOCK

This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the sei whale is listed as an endangered species under the ESA. A final recovery plan for the sei whale was published in 2011 (NMFS 2011). The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is not less than 10% of the calculated PBR, and therefore cannot be considered insignificant and approaching the ZMRG. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown~~, but the species is listed as endangered under the ESA~~. There are insufficient data to determine population trends for sei whales.

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MINKE WHALE (*Balaenoptera acutorostrata acutorostrata*): Canadian East Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Minke whales have a cosmopolitan distribution in temperate, tropical, and high-latitude waters. In the North Atlantic, there are four recognized populations—Canadian East Coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). These divisions were defined by examining segregation by sex and length, catch distributions, sightings, marking data and pre-existing ICES boundaries. However, there were very few data from the Canadian East Coast population. Anderwald *et al.* (2011) found no evidence for geographic structure comparing these putative populations but did, using individual genotypes and likelihood assignment methods, identify two cryptic stocks distributed across the North Atlantic. Until better information is available, minke whales off the eastern coast of the United States are considered to be part of the Canadian East Coast stock, which inhabits the area from the western half of the Davis Strait (45ºW) to the Gulf of Mexico. It is also uncertain if there are separate sub-stocks within the Canadian East Coast stock.

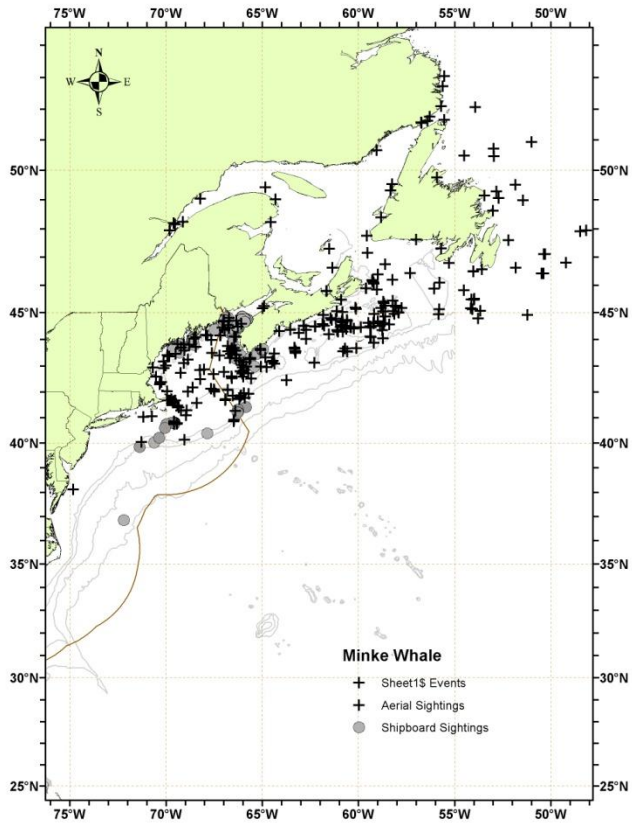

Figure 1. *Distribution of minke whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

The minke whale is common and widely distributed within the U.S. Atlantic Exclusive Economic Zone (EEZ) (CETAP 1982). There appears to be a strong seasonal component to minke whale distribution. Spring and summer are times of relatively widespread and common occurrence, and when the whales are most abundant in New England waters. In New England waters during fall there are fewer minke whales, while during winter the species appears to be largely absent. Like most other baleen whales, minke whales generally occupy the continental shelf proper (< 100 m deep), rather than the continental shelf-edge region. Records summarized by Mitchell (1991) hint at a possible winter distribution in the West Indies, and in the mid-ocean south and east of Bermuda. As with several other cetacean species, the possibility of a deep-ocean component to the distribution of minke whales exists but remains unconfirmed.

POPULATION SIZE

Multiple estimates are available for portions of minke whale habitat (see Appendix IV for details on these surveys and estimates). The best recent abundance estimate for this stock is 20,741 (CV=0.30) minke whales. This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007 and is considered best because, while it did not cover any U.S. waters, the survey covered more of the minke whale range than the other surveys reported here.

Earlier estimates

For earlier abundance estimates please see Appendix IV.

Recent surveys and abundance estimates

~~An abundance estimate of 600 (CV=0.61) minke whales was obtained from a line transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 6,180 km of trackline from the 100-m depth contour on southern Georges Bank to the lower Bay of Fundy. The Scotian Shelf south of Nova Scotia was not surveyed (Table 1; Palka 2006). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995), accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.~~

An abundance estimate of 3,312 (CV=0.74) minke whales was generated from an aerial survey conducted in August 2006, which surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 20,741 (CV=0.30) minke whales was generated from the TNASS in July-August 2007. This survey covered from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling ~~(MRDS)~~, and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (~~2007~~1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 2,591 (CV=0.81) minke whales was generated from a shipboard and aerial survey conducted during June-August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central ~~North Carolina~~Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a ~~two simultaneous team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the multiple covariate distance sampling (MCDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

No minke whales were detected in aerial and shipboard~~An~~ abundance surveys ~~was~~ conducted ~~concurrently in the southern U.S. waters~~ concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology~~two independent visual teams~~ searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

~~(from Virginia~~~~North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~

Table 1. Summary of abundance estimates for the Canadian east coast stock of minke whales *(Balaenoptera acutorostrata acutorostrata)* with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation. (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Jul 2004~~	~~Gulf of Maine to lower Bay of Fundy~~	~~600~~	~~0.61~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	3,312	0.74
Jul-Aug 2007	N. Labrador to Scotian Shelf	20,741	0.30
Jul-Aug 2011	~~North Carolina~~Central Virginia to lower Bay of Fundy	2,591	0.81

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for minke whales is 20,741animals (CV=0.30). The minimum population estimate for the Canadian East Coast minke whale is 16,199 animals.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~A Population trends for this species are currently being investigated and will be reported when completed.population trend analysis for this species has not been conducted.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity are that females mature between 6 and 8 years of age, and pregnancy rates are approximately 0.86 to 0.93. Based on these parameters, the calving interval is between 1 and 2 years. Calves are probably born during October to March after 10 to 11 months gestation and nursing lasts for less than 6 months. Maximum ages are not known, but for Southern Hemisphere minke whales maximum age appears to be about 50 years (IWC 1991; Katona *et al.* 1993).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 16,199. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status, relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for the Canadian east coast minke whale is 162.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During ~~2006~~ 2007 to ~~2010~~2011, the average annual minimum detected human-caused mortality and serious injury was ~~5.64.68.05~~7.85 minke whales per year (1.8~~2.6~~ ~~(0.4246)~~ minke whales per year from observed U.S. fisheries, ~~1.205.25~~5.05 minke whales per year (unknown CV) from U.S. and Canadian fisheries using strandings and

entanglement data, ~~0.6~~2.0 ~~(unknown CV) from Canadian fisheries using strandings and entanglement data,~~ and 1.0~~0.4~~ per year from ~~U.S.~~ ship strikes ~~(Henry *et al.* 2012))~~.

Data to estimate the mortality and serious injury of minke whales come from the Northeast Fisheries Science Center Observer Program, the At-Sea Monitor Program, and from records of strandings and entanglements in U.S. and Canadian waters. For the purposes of this report, only those unobserved strandings and entanglement records considered confirmed human-caused mortalities or serious injuries are shown in Table 2, while mortalities and serious injuries recorded by the Observer or At-Sea Monitor Programs are recorded in Table 3.

Detected ~~mortalities~~ interactions in the strandings and entanglement data should not be considered an unbiased representation of human-caused mortality. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate which is almost certainly biased low.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). ~~-~~NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

~~-~~For more details on the historical fishery interactions prior to 1999, see Waring *et al.* (2007).

In 2002, one minke whale mortality and one live release were attributed to the lobster trap fishery. ~~The 28~~A June 2003 mortality, while wrapped in lobster gear, cannot be confirmed to have become entangled in the area, and so is not attributed to the fishery. Annual mortalities due to the Northeast/mid-Atlantic Lobster Trap/Pot fishery, as determined from strandings and entanglement records that have been audited, were 1 in 1991, 2 in 1992, 1 in 1994, 1 in 1995, 0 in 1996, 1 in 1997, 0 in 1998 to 2001, 1 in 2002, and 0 in 2003 through ~~2010~~2011.

U.S.

Northeast Bottom Trawl

The fishery is active in New England waters in all seasons. Detailed fishery information is reported in Appendix III. One freshly dead minke whale was caught in 2004 on the northeastern tip of Georges Bank in U.S. waters. Two dead minkes were reported by observers in 2008. Fisheries observer data from the years 2005 through 2009 were pooled and bycatch rates for minke whales were estimated using a stratified ratio-estimator. Estimated bycatch rates from the pooled fisheries observer data were expanded by annual (2006–2010) fisheries data collected from mandatory vessel trip reports. The estimated annual mortality (CV in parentheses) attributed to this fishery was 3.7~~1~~ (0.73) for 2006, 3.3~~28~~ (0.72) for 2007, 2.9~~86~~ (0.73) for 2008, 2.9~~86~~ (0.75) for 2009 and 0 for 2010 and 2011. Annual average estimated minke whale mortality and serious injury from the Northeast bottom trawl fishery during ~~2006~~ 2007 to ~~2010~~ 2011 was ~~2.6~~1.8 (CV=~~0.46~~0.42)(Table 3).

Pelagic Longline

In 2010, a minke whale was caught but released alive (no serious injury) in the pelagic longline fishery, South Atlantic Bight fishing area (Garrison and Stokes 2012).

~~**Unknown**~~ **Other Fisheries**

The audited NE Regional Office/NMFS entanglement/stranding database contains records of minke whales, of which the confirmed mortalities and serious injuries ~~and serious injuries~~ from the last five years are reported in Table 2~~ and the serious injuries are reported in Cole and Henry (*in prep*)~~. During 2007 to 2011, as determined from ~~U.S. and unknown waters~~ strandings~~s~~ and entanglement records confirmed to be of U.S. origin or first sighted in U.S. waters, t~~6 observed mortalities due to fishery interactions were confirmed; of which 2 were attributed to the lobster trap/pot fishery (Table 2). T~~ the minimum detected average annual mortality and serious injury ~~during 2007 – 2011~~ was ~~1.2~~3.~~2~~0 minke whales per year in U.S. fisheries.

~~Mortalities (and serious injuries) that were likely a result of a U.S. fishery interaction with an unknown fishery include 3 (0) in 1997, 3 (0) in 1999, 1 (1) in 2000, 2 (0) in 2001, 1 (0) in 2002, 5 (0) in 2003, 2 (0) in 2004, 0 (0) in 2005, 0 (0) in 2006, 1 (1) in 2007, 1 (0) in 2008, 0 (1) in 2009, and 0 (1) in 2010 (Table 2). During 2006 to 2010, as determined from strandings and entanglement records, the minimum detected average annual mortality and serious injury is 1.0 minke whales per year in unknown U.S. fisheries (Table 2).~~

CANADA

Read (1994) reported interactions between minke whales and gillnets in Newfoundland and Labrador, in cod traps in Newfoundland, and in herring weirs in the Bay of Fundy. Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in Canadian waters, on between 25% and 40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. During 1991 through 1996, no minke whales were observed taken.

Herring Weirs

During 1980 to 1990, 15 of 17 minke whales were released alive from herring weirs in the Bay of Fundy. During January 1991 to September 2002, 26 minke whales were trapped in herring weirs in the Bay of Fundy. Of these 26, 1 died (H. Koopman, pers. comm.) and several (number unknown) were released alive and unharmed (A. Westgate, pers. comm.). Four minke whales were reported released alive from Grand Manan herring weirs in 2009 (H. Koopman pers. comm.).

Other Fisheries

~~Six minke whales were reported entangled during 1989 in the groundfish gillnet fishery in Newfoundland and Labrador (Read 1994). One of these animals escaped and was still towing gear, the remaining five animals died.~~

~~Salmon gillnets in Canada, now no longer used, had taken a few minke whales. In Newfoundland in 1979, one minke whale died in a salmon net. In Newfoundland and Labrador, between 1979 and 1990, it was estimated that 15% of the Canadian minke whale takes were in salmon gillnets. A total of 124 minke whale interactions were documented in cod traps, groundfish gillnets, salmon gillnets, other gillnets, and other traps. The salmon gillnet fishery ended in 1993 as a result of an agreement between the fishermen and North Atlantic Salmon Fund (Read 1994).~~

~~Five minke whales were entrapped and died in Newfoundland cod traps during 1989. The cod trap fishery closed in Newfoundland in 1993 due to the depleted groundfish resources (Read 1994).~~

~~In 2004, two minke whales were reported dead in entangled fishing gear off Newfoundland and Labrador, one in a blackback flounder net, and one in crab gear (Ledwell and Huntington 2004). Only the flounder net animal had enough information to include it as a human-caused mortality. In 2005, four minke whales were reported entangled in fishing gear in Newfoundland and Labrador. Two (entangled in salmon net and mackerel trap gear) were released alive and two (involved with whelk pot and toad crab pot fisheries) were dead (Ledwell and Huntington 2006). The whelk pot mortality could not be conclusively attributed to human causes. In 2006, one minke whale was reported dead in a mackerel trap off Newfoundland (Ledwell and Huntington 2007). In 2007, four minke whales in Newfoundland and Labrador were reported entangled, but released alive (Ledwell and Huntington 2008). In 2008, four minkes were reported entangled in Newfoundland and Labrador. Two of these were dead and two were released alive, though one of the live releases was listed as "condition uncertain" (Ledwell and Huntington 2009). In 2008, one minke was reported dead in an unknown fishery off New Brunswick. In 2009, one minke whale was determined to have been seriously injured off Quebec. In 2010, a minke whale was released alive from a mackerel seine in La Poile Bay, Newfoundland (Ledwell and Huntington 2011).~~ Mortalities ~~(~~and serious injuries~~)~~ that were likely a result of an interaction with an unknown Canadian fishery ~~include~~ are detailed in ~~t~~Table 2. ~~1(0) in 2005, 1(0) in 2006, 0(0) in 2007, 3(0) in 2008, 0 (1) in 2009, and 4 (1) in 2010.~~ ~~aAnd serious injuries are included in the determinations made by the NEFSC (Cole and Henry *in prep*).~~ During ~~2006~~ 2007 to ~~2010~~2011, as determined from ~~Canadian~~ strandings and entanglement records confirmed to be of Canadian origin or first sighted in Canadian waters, t~~3 observed mortalities due to fishery interactions were confirmed; of which 1 were attributed to the lobster trap/pot fishery and 1 to the blackback flounder fishery (Table 2). T~~the minimum detected average annual mortality and serious injury ~~during 2007 – 2011~~ was 2.05 ~~2.0~~2.05 minke whales per year in Canadian fisheries.

Table 2. Confirmed human-caused mortality records of minke whales (*Balaenoptera acutorostrata acutorostrata*) where the cause was assigned as either an entanglement (EN) or a ship strike (SS): 2007-2011 [a]

Date[b]	Report Type	ID	Location[b]	Assigned Cause	Value against PBR[c]	Country[d]	Gear Type[e]
7/7/2007	Unknown	-	Provincetown harbor, MA	EN	0.75	XU	NR
7/11/2007	Unknown	-	Duntarra, Trinity Bay	EN	0.75	CN	GN
7/16/2007	Serious Injury	-	1 nm S of Eastern Head, Trescott, ME; 27 nm NE of Jonesport, ME	EN	1	US	NR
8/5/2007	Mortality	-	Cape Cod Bay, MA	EN	1	XU	GU
9/24/2007	Unknown	-	Massachusetts Bay; 8 nm E of Marblehead Neck and 8 nm S of Gloucester, MA	EN	0.75	XU	NR
3/11/2008	Unknown	-	Off Yarmouth, NS	EN	0.75	XC	NR
6/14/2008	Mortality	-	Orleans, MA	EN	1	US	NP
6/19/2008	Unknown	-	Grand Manan Island, NB	EN	0.75	XC	NR
7/23/2008	Mortality	-	Kelligrews, NL	EN	1	CN	GU
7/26/2008	Mortality	-	Conception Bay, NL	EN	1	CN	-
7/28/2008	Unknown	-	Hopeall Point, Trinity Bay	EN	0.75	CN	GN
8/20/2008	Unknown	-	off Outer Heron Island, Boothbay Harbor, ME	EN	0.75	XU	NR
8/25/2008	Mortality	-	off Richibucto Cape, NB	EN	1	CN	NR
9/21/2008	Unknown	-	~8 nm SSW of Port Clyde, ME	EN	0.75	XU	NR
10/9/2008	Unknown	-	near Isles of Shoals, NH	EN	0.75	XU	NR
4/19/2009	Unknown	-	Grand Le Pierre, Fortune Bay, Labrador	EN	0.75	CN	PT
5/20/2009	Mortality	-	off Point Pleasant, NJ	SS	1	US	-

6/3/2009	Serious Injury	-	Tadoussac, Northern Gulf of St. Lawrence	EN	1	CN	NR
8/11/2009	Serious Injury	-	8 mi E of Plymouth, MA	EN	1	XU	NR
9/2/2009	Unknown	-	~5 mi S of Pumpkin Island, ME	EN	0.75	XU	NR
10/11/2009	Serious Injury	-	~ 9 mi from Cape Cod National Sea Shore	EN	1	US	MT
7/9/2010	Mortality	-	Fire Island, NY	SS	1	US	-
8/21/2010	Serious Injury	-	Plymouth Harbor, MA	EN	1	XU	NR
5/6/2011	Mortality	-	off Martha's Vineyard, MA	EN	1	US	PT
7/17/2011	Unknown	-	outside Boston Harbor	EN	0.75	XU	NR
7/24/2011	Unknown	-	Highland Light, Cape Cod	EN	0.75	XU	NR
8/4/2011	Mortality	-	off Sandy Hook, NJ	SS	1	US	-
8/26/2011	Mortality	-	off Sandy Hook, NJ	EN	1	US	NP
8/29/2011	Mortality	-	Moriches, NY	SS	1	US	-
9/7/2011	Unknown	-	Greenspond, BB	EN	0.75	CN	GN
9/19/2011	Unknown	-	Northumberland Strait, Pointe-Sapin, PEI	EN	0.75	CN	NR
10/6/2011	Mortality	-	off Matinicus Island, ME	EN	1	US	PT
12/7/2011	Mortality	-	Carolina Beach, NC	SS	1	US	-
12/19/2011	Mortality	-	Bay of Fundy	EN	1	CN	PT
Five-year averages		Shipstrike (US/CN/XU/XC)			1.00 (1.00/ 0.00/ 0.00/ 0.00)		
		Entanglement (US/CN/XU/XC)			5.05 (1.20/ 1.75/ 1.80/ 0.30)		

a. For more details on events please see Cole and Henry in press and Henry *et al*. in press.

b. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

c. Mortality events are counted as 1 against PBR. Serious injury events have been prorated using NMFS guidelines (NOAA 2012)

d. CN=Canada, US=United States, XC=Unk 1st sight in CN, XU=Unk 1st sight in US

e. H=hook, GN=gillnet, GU=gear unidentifiable, MF=monofilament, MT=Midwater Trawl, NP=none present, NR=none recovered/received, PT=pot/trap, WE=weir

Table 2. Confirmed human-caused mortality and serious injury records of Canadian East Coast minke whales *(Balaenoptera acutorostrata)*, 2006 – 2010.

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entanglement/ Fishery interaction	
09/22/06[b]	mortality	age & sex unknown	Woods Cove, Great Northern Peninsula, NL	-	P	Anchored by tail in doorways of the gear; mackerel trap
7/16/2007	serious injury	age & sex unknown 10m (est)	Trescott, ME	-	P	Wrapped in gear and anchored; no gear recovered
8/5/2007	mortality	Juvenile Female 4.3m	Cape Cod Bay, MA	-	P	Chronic entanglement with severe emaciation and dehydration and loss of protein; line lacerated blubber layer across back and at flipper insertions; severe hemorrhage and necrosis of blubber at gear entanglement points; gear consists of 11/16" diameter floating rope

~~6/14/2008~~	~~mortality~~	~~Juvenile Female 4.7m~~	~~Orleans, MA~~	~~-~~	~~P~~	~~Braided line impressions wrapped the body in 3 places and left a deep, hemorrhaged laceration across the rostrum and blowholes; hemorrhaged abrasions present on roof of mouth; wet, blood-filled lungs indicate drowning; no gear present~~
~~7/23/2008~~	~~mortality~~	~~age & sex unknown 7m (est)~~	~~Kelligrews, NL~~	~~-~~	~~P~~	~~Constricting wraps of gear on caudal peduncle; 5/8" polypropylene rope~~
~~7/26/2008~~	~~mortality~~	~~age & sex unknown~~	~~Conception Bay, NL~~	~~-~~	~~P~~	~~Constricting wraps of gear through mouth and around tail; blackback flounder nets~~
~~8/25/2008~~	~~mortality~~	~~age & sex unknown 8m (est)~~	~~off Richibucto Cape, NB~~	~~-~~	~~P~~	~~Evidence of constricting body wraps; gear not recovered~~
~~5/20/2009~~	~~mortality~~	~~Adult sex unknown 8m (est)~~	~~off Point Pleasant, NJ~~	~~P~~	~~-~~	~~Large hemorrhage at right pectoral~~
~~6/3/2009~~	~~serious injury~~	~~age & sex unknown~~	~~off Tadoussac, Quebec~~	~~-~~	~~P~~	~~Free-swimming with tight rostrum wrap; no gear recovered~~
~~8/11/2009~~	~~serious injury~~	~~age & sex unknown~~	~~off Plymouth, MA~~	~~-~~	~~P~~	~~Constricting wrap on rostrum & poor skin condition; no gear recovered~~
~~7/9/2010~~	~~mortality~~	~~Juvenile Male 5.7m~~	~~Fire Island, NY~~	~~P~~	~~-~~	~~3-4 large dorsal lacerations associated with fractured ribs~~
~~8/21/2010~~	~~serious injury~~	~~Adult sex unknown~~	~~Plymouth Harbor, MA~~	~~-~~	~~P~~	~~Embedded rostrum wrap; no gear recovered~~

~~a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.~~

~~b. Additional record which was not included in previous reports.~~

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Table 3. Summary of the incidental mortality of Canadian East Coast stock of minke whales (*Balaenoptera acutorostrata acutorostrata*) by commercial fishery including the years sampled~~ (Years)~~, the type of data used ~~(Data Type)~~, the annual observer coverage~~ (Observer Coverage)~~, the serious injuries and mortalities recorded by on-board observers ~~(Observed Mortality)~~, the estimated annual serious injury and mortality~~ (Estimated Mortality)~~, the estimated CV of the combined annual mortality~~ (Estimated CVs)~~ and the mean annual mortality (CV in parentheses).

Fishery [a]	Years	Data Type [b]	Observer Coverage [c] ~~b~~	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Northeast Bottom Trawl	~~06~~07-~~10~~11	Obs. Data, ~~Dealer Data~~ Trip Logbook~~VTR Data~~	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 0, 0	~~0,~~ 0, 2, 0, 0, 0	0, 0, 0, 0, 0	~~3.7,~~ 3.3, 2.9, 2.9, 0, 0	~~3.7,~~ 3.3, 2.9, 2.9, 0, 0	~~.73,~~ .72, .73, .75, 0, 0	~~2.6~~1.8 (~~.46~~.42)
TOTAL										~~2.6 (.46)~~1.8 (.42)

~~a.~~

[a]Bycatch rates were estimated from fisheries observer data pooled over years 2005-2009.~~ A new five year time period will beginbegan in 2010.~~ Fisheries observer data from the years 2010-2014 will be pooled to estimate bycatch rates for minke whales for the same five year time period. No takes of minke whales were observed or monitored in 2010 or 2011. As a result the estimated mortality is zero.

[b]. Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Fisheries Observer Program and mandatory Vessel Trip Reports (VTR) (Trip Logbook) are used to determine the spatial distribution of landings and fishing effort.

~~b.~~

[c]~~T~~Northeast bottom trawl fishery coverage is ratios based on trips. Total observer coverage reported for bottom trawl gear in the year 2010 and 2011 includes samples collected from traditional fisheries observers, in addition to at-sea fishery monitors (both programs currently run through the Northeast Fisheries Observer Program (NEFOP). ~~In the Northeast region, 437 and 658 trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 trips were sampled by observers and monitors, respectively.~~

Other Mortality

Minke whales have been and continue to be hunted in the North Atlantic outside of U.S. waters. From the Canadian East Coast population, documented whaling occurred from 1948 to 1972 with a total kill of 1,103 animals (IWC 1992). Animals from other North Atlantic minke populations are presently still being harvested.

U.S.

Minke whales inhabit coastal waters during much of the year and are thus ~~subject~~ susceptible to collision with vessels. According to the NMFS/NER marine mammal entanglement and stranding database, on 7 July 1974, a necropsy of a minke whale suggested a vessel collision; on 15 March 1992, a juvenile female minke whale with propeller scars was found floating east of the St. Johns Channel entrance (R. Bonde, USFWS, Gainesville, FL, pers. comm.); and on 15 July 1996 the captain of a vessel reported hitting a minke whale offshore of Massachusetts. After reviewing this record, it was concluded the animal struck was not a serious injury or mortality. On 12 December 1998, a minke whale was struck and presumed killed by a whale-watching vessel in Cape Cod Bay off Massachusetts.

During 1999 to 2003, no minke whale was confirmed struck by a ship. During 2004 and 2005, one minke whale mortality was attributed to ship strike in each year~~ (Table 2)~~. During 2006 to 2008, no minke whale was confirmed struck by a ship. During 2009, one minke whale was confirmed dead due to a ship strike off New Jersey. I~~ and i~~n

2010 a juvenile male minke was discovered killed by ship strike off Fire Island, New York. In 2011, three juvenile minkes were confirmed dead due to a ship strike: a female off Sandy Hook, NJ, female off Moriches, NY, and a male off of Carolina Beach, NC. Thus, during 2007~~6 to~~ –2011~~0~~, as determined from stranding and entanglement records, the minimum detected annual average was 1.0~~0.4~~ minke whale~~s~~ per year struck by ships in U.S. waters.

In October 2003, an Unusual Mortality Event was declared involving minke whales and harbor seals along the coast of Maine; since then, the number of minke whale stranding reports has returned to normal. Stranding mortalities and serious injuries that have been determined to be human-caused are included in Table 2 (Henry *et al.* ~~2012~~in press).

On 11 October 2009, the NOAA research vessel FSV Delaware II captured a minke whale during mid-water trawling operations associated with the 2009 Atlantic Herring Acoustics survey. Although brought on deck, the animal was released alive and appeared to exhibit healthy behavior upon release. This record was evaluated under the serious injury determination guidelines (NOAA 2012) and included in Table 2 as a serious injury.

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded on the coast of Nova Scotia between 1991 and 1996 (Hooker *et al.* 1997). Researchers with the Department of Fisheries and Oceans, Canada documented strandings on the beaches of Sable Island (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. Lucas and Hooker (2000) reported 4 minke whales stranded on Sable Island between 1970 and 1998, 1 in spring 1982, 1 in January 1992, and a mother/calf in December 1998. On the mainland of Nova Scotia, a total of 7 minke whales stranded during 1991 to 1996. The 1996 stranded minke whale was released alive off Cape Breton on the Atlantic Ocean side, the rest were found dead. All the minke whales stranded between July and October. One was from the Atlantic Ocean side of Cape Breton, 1 from Minas Basin, 1 was at an unknown location, and the rest stranded in the vicinity of Halifax, Nova Scotia. It is unknown how many of the strandings resulted from fishery interactions.

Whales and dolphins stranded between 1997 and ~~2009~~ 2011 on the coast of Nova Scotia as recorded by the Marine Animal Response Society (MARS) and the Nova Scotia Stranding Network are as follows: 4 minke whales stranded in 1997, 0 documented strandings in 1998 to 2000, 1 in September 2001, 4 in 2002, 2 in 2003, 0 in 2004, 3 in 2005, 8 in 2006, 1 in 2007, 4 (including the entangled animal listed in Table 2) in 2008, ~~and~~ 5 in 2009 (including one minke released alive from a weir), 0 in 2010 and 4 in 2011 (including 2 animals released or relocated).

The Whale Release and Strandings program has reported ~~8~~ 7 minke whale stranding mortalities in Newfoundland and Labrador between ~~2006~~ 2007 and ~~2010~~2011; ~~1 in 2006,~~ 2 in 2007, 3 in 2008, 1 in 2009~~ and~~, 1 in 2010 and 0 in 2011. ~~Three~~ Two of these records are included in Table 2 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010, 2011, 2012). The 2011 Bay of Fundy minke whale entanglement mortality reported in Table 2 was reported by the Nova Scotia Marine Animal Response Society (T. Wimmer, pers. comm.).

STATUS OF STOCK

Minke whales are not listed as threatened or endangered under the Endangered Species Act, and the Canadian east coast stock is not considered strategic under the Marine Mammal Protection Act. ~~This is not a strategic stock because estimated human-related mortality and serious injury does not exceed PBR, and the minke whale is not listed as a threatened or endangered species under the Endangered Species Act (ESA).~~ The total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of minke whales, relative to OSP, in the U.S. Atlantic EEZ is unknown.

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SPERM WHALE (*Physeter macrocephalus*): North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of the sperm whale in the U.S. Exclusive Economic Zone (EEZ) occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions (Figure 1). Waring *et al.* (1993, 2001) suggested that this offshore distribution is more commonly associated with the Gulf Stream edge and other features. However, the sperm whales that occur in the eastern U.S. Atlantic EEZ likely represent only a fraction of the total stock. The nature of linkages of the U.S. habitat with those to the south, north, and offshore is unknown. Historical whaling records compiled by Schmidly (1981) suggested an offshore distribution off the southeast U.S., over the Blake Plateau, and into deep ocean waters. In the southeast Caribbean, both large and small adults, as well as calves and juveniles of different sizes are reported (Watkins *et al.* 1985). Whether the northwestern Atlantic population is discrete from northeastern Atlantic is currently unresolved. The International Whaling Commission recognizes one stock for the North Atlantic. Based on reviews of many types of stock studies, (i.e., tagging, genetics, catch data, mark-recapture, biochemical markers, etc.) Reeves and Whitehead (1997) and Dufault *et al.* (1999) suggested that sperm whale populations have no clear geographic structure. Ocean-wide genetic studies (Lyrholm and Gyllensten 1998; Lyrholm *et al.* 1999) indicated low genetic diversity, but strong differentiation between potential social (matrilineally related) groups. Further, Englehaupt ~~et al~~*et al*. (2009) found no differentiation for mtDNA between samples from the western North Atlantic and from the North Sea, but significant differentiation between samples from the Gulf of Mexico and from the Atlantic Ocean just outside the Gulf of Mexico. These ocean-wide findings, combined with observations from other studies, indicate stable social groups, site fidelity, and latitudinal range limitations in groups of females and juveniles (Whitehead 2002). In contrast, males migrate to polar regions to feed and move among populations to breed (Whitehead 2002, Englehaupt 2009). There exists one tag return of a male tagged off Browns Bank (Nova Scotia) in 1966 and returned from Spain in 1973 (Mitchell 1975). Another male taken off northern Denmark in August 1981 had been wounded the previous summer by whalers off the Azores (Reeves and Whitehead 1997). Steiner ~~et al~~*et al*. (2012) reported on the resightings of photographed individual male sperm whales between the Azores and Norway. In the U.S. Atlantic EEZ waters, there appears to be a distinct seasonal cycle (CETAP 1982; Scott and Sadove 1997). In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to east of Delaware and Virginia, and is widespread throughout the central portion of the mid-Atlantic bight and the southern portion of Georges Bank. In summer, the distribution is similar but now also includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100-m isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level, and there remains a continental shelf edge occurrence in the mid-Atlantic bight. Similar inshore (<200 m) observations have been made on the southwestern (Kenney, pers. comm) and eastern Scotian Shelf, particularly in the region of "the

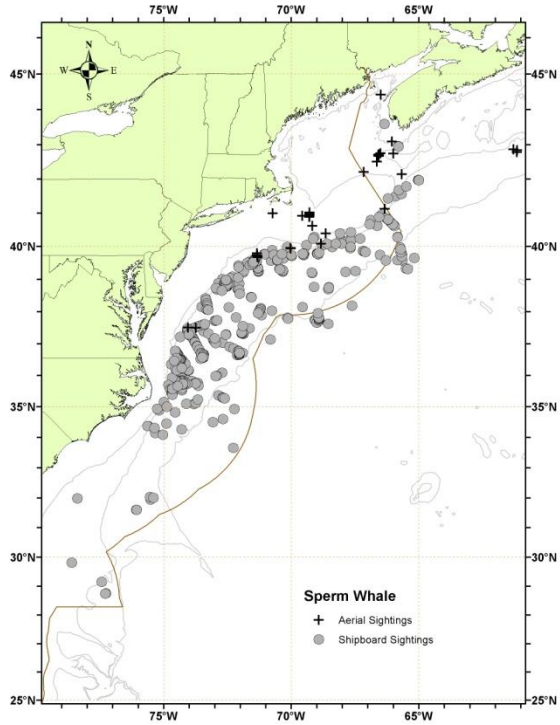

Figure 1. *Distribution of sperm whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, 1999, 2002, 2004, 2006 and 2011. Isobaths are the 100m, 1,000m, and 4,000m depth contours.*

Gully" (Whitehead *et al.* 1991).

Geographic distribution of sperm whales may be linked to their social structure and their low reproductive rate and both of these factors have management implications. Several basic groupings or social units are generally recognized——nursery schools, harem or mixed schools, juvenile or immature schools, bachelor schools, bull schools or pairs, and solitary bulls (Best 1979; Whitehead *et al.* 1991; Christal *et al.* 1998). These groupings have a distinct geographical distribution, with females and juveniles generally based in tropical and subtropical waters, and males more wide-ranging and occurring in higher latitudes. Male sperm whales are present off and sometimes on the continental shelf along the entire east coast of Canada south of Hudson Strait, whereas, females rarely migrate north of the southern limit of the Canadian EEZ (Reeves and Whitehead 1997; Whitehead 2002). Off the northeast U.S., Cetacean and Turtle Assessment Program (CETAP) and NEFSC sightings in shelf-edge and off-shelf waters included many social groups with calves/juveniles (CETAP 1982; Waring *et al.* 1992, 1993). The basic social unit of the sperm whale appears to be the mixed school of adult females plus their calves and some juveniles of both sexes, normally numbering 20-40 animals in all. There is evidence that some social bonds persist for many years (Christal *et al.* 1998).

POPULATION SIZE

Several estimates from selected regions of sperm whale habitat exist for select time periods, however, at present there is no reliable estimate of total sperm whale abundance in the entire western North Atlantic. Sightings have been almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best recent abundance estimate for sperm whales is the ~~result~~ sum of the 2011 surveys—~~1,593~~2,288 (CV=~~0.36~~0.28). Because all the sperm whale estimates presented here were not corrected for dive-time, they are likely downwardly biased and an underestimate of actual abundance. The average dive-time of sperm whales is approximately 30-60 min (Whitehead *et al.* 1991; Watkins *et al.* 1993; Amano and Yoshioka 2003; Watwood *et al.* 2006), therefore, the proportion of time that they are at the surface and available to visual observers is assumed to be low.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~Due to changes in survey methodology these data should not be used to make comparisons to more current estimates~~Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

~~An abundance of 2,607 (CV=0.57) sperm whales was estimated from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of trackline in waters north of Maryland (about 38ºN) to the Bay of Fundy (about 45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent-team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38ºN) was conducted during June–August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and there were a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were analyzed to correct for visibility bias (*g(0)*) and group-size bias employing line-transect distance analysis and the direct duplicate estimator (Palka 1995; Buckland *et al.*, 2001). The resulting abundance estimate for sperm whales between Florida and Maryland was 2,197 (CV=0.47) (Table 1).~~

An abundance estimate of 1,593 (CV=0.36) sperm whales was generated from a shipboard and aerial survey conducted during Jun–Aug 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portioned covered 3,107 km of tracklines that were in waters offshore of Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a

~~two simultaneous team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). ~~In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time~~

An abundance estimate of 695 (CV=0.39) sperm whales was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology~~two independent visual teams~~ searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic sperm whale *(Physeter macrocephalus)*. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun–Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~2,607~~	~~0.57~~
~~Jun–Aug 2004~~	~~Florida to Maryland~~	~~2,197~~	~~0.47~~
~~Jun–Aug 2004~~	~~Bay of Fundy to Florida (COMBINED)~~	~~4,804~~	~~0.38~~
Jun–Aug 2011	Central Virginia to lower Bay of Fundy	1,593	0.36
Jun-Aug 2011	Central Florida to Central Virginia	695	0.39
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	2,288	0.28

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for sperm whales is ~~1,593~~2,288 (CV=~~0.36~~0.28). The minimum population estimate for the western North Atlantic sperm whale is ~~1,187~~1,815.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~is~~

~~There are insufficient data to determine the population trends for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. While more is probably known about sperm whale life history in other ~~areas~~regions, some life history and vital rates information is available for the northwest Atlantic. These include: calving interval is 4-6 years; lactation period is 24 months; gestation period is 14.5-16.5 months; births occur mainly in July to November; length at birth is 4.0 m; length at sexual maturity 11.0-12.5 m for males and 8.3-9.2 m for females; mean age at sexual maturity is 19 years for males and 9 years for females; and mean age at physical maturity is 45 years for males and 30 years for females (Best 1974; Best *et al.* 1984; Lockyer 1981; Rice 1989).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~1,187~~1,815. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because the sperm whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic sperm whale is ~~2.4~~3.6.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During ~~2006~~2007~~-2010~~2011, annual average human caused mortality was 0.~~6~~ 4 due to ~~one report of a ship strike mortality in 2006 and~~ reports of one sperm whale mortality in 2009 and one in 2010 in the Canadian Labrador halibut longline fishery (J. Lawson, DFO, pers. comm.). A sperm whale was reported entangled in monkfish net on the Canadian Grand Banks in 2011, but was released alive and gear free (Ledwell and Huntington, 2012; Cole and Henry *in prep*.). Sperm whales have not been documented as bycatch in the observed U.S. Atlantic commercial fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

Other Mortality

Four hundred twenty-four sperm whales were harvested in the Newfoundland-Labrador area between 1904 and 1972 and 109 male and no female sperm whales were taken near Nova Scotia in 1964-1972 (Mitchell and Kozicki 1984) in a Canadian whaling fishery. There was also a well-documented sperm whale fishery based on the west coast of Iceland. Other sperm whale catches occurred near West Greenland, the Azores, Madeira, Spain, Spanish Morocco, Norway (coastal and pelagic), the Faroes, and Britain. At present, because of their general offshore distribution, sperm whales are less likely to be impacted by humans and those impacts that do occur are less likely to be recorded. There has been no complete analysis and reporting of existing data on this topic for the western North Atlantic.

During 1994~~-2005~~2006, ~~thirty three~~37 sperm whale strandings have been documented along the U.S. Atlantic coast ~~and in~~including Puerto Rico and the EEZ (NMFS unpublished data). One 1998 and one 2000 stranding off Florida showed signs of human interactions. The 1998 animal's head was severed, but it is unknown if it occurred pre- or post-mortem. The 2000 animal had fishing gear in the blowhole. ~~In 2001, the U.S. Navy reported a ship strike in EEZ waters.~~ In October 1999, a live sperm whale calf stranded on eastern Long Island, and was subsequently euthanized. Also, a dead calf was found in the surf off Florida in 2000.

During ~~2006~~2007–~~2010~~2011, ~~11~~ 13 sperm whale strandings were documented along the U.S. Atlantic coast within the EEZ according to the NER and SER strandings databases (Table 2). None of the U.S. strandings were classified as human interactions.

Table 2~~:~~. Sperm whale (*Physeter macrocephalus*) reported strandings along the U.S. and Canada Atlantic coast 2007–2011.

Stranding State	2007	2008	2009	2010	2011	**Total**
Newfoundland/Labrador[a]	4	1	1	0	2	**8**
Maine	1	0	0	0	0	**1**
Massachusetts	0	0	0	0	2	**2**
New York	1	0	1	0	1	**3**
Virginia	0	0	0	0	0	**0**
North Carolina	0	1	0	1	1	**3**
South Carolina	0	0	0	0	1	**1**
Florida	0	1	0	1[b]	0	**2**
EEZ	1	0	0	0	0	**1**
TOTAL U.S.	**2**	**2**	**1**	**2**	**5**	**13**

a. Data provided by Whale Release and Strandings, Tangly Whales Inc. Newfoundland, Canada

b. Young sperm whale swimming in the Miami Beach Marina eluded euthanasia attempts.

~~Table 2: Sperm whale (*Physeter macrocephalus*) reported strandings along the U.S. and Canada Atlantic coast 2006–2010~~

~~Stranding State~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~**Total**~~
~~Newfoundland/Labrador[a]~~	~~3~~	~~4~~	~~1~~	~~1~~	~~0~~	~~**9**~~
~~New York~~	~~0~~	~~1~~	~~0~~	~~1~~	~~0~~	~~**2**~~
~~North Carolina~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1~~	~~**3**~~
~~Florida~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1[b]~~	~~**3**~~
~~EEZ~~	~~2~~	~~1~~	~~0~~	~~0~~	~~0~~	~~**3**~~
~~**TOTAL U.S.**~~	~~**4**~~	~~**2**~~	~~**2**~~	~~**1**~~	~~**2**~~	~~**11**~~

~~a. Data provided by Whale Release and Strandings, Tangly Whales Inc. Newfoundland, Canada~~
~~b. Young sperm whale swimming in the Miami Beach Marina eluded euthanasia attempts.~~

In eastern Canada, 6 dead strandings were reported in Newfoundland/Labrador in 1987-2005; 20 dead strandings along Nova Scotia in 1988-2005; 9 dead strandings on Prince Edward Island in 1988-2005; 2 dead strandings in Quebec in 1992; 5 dead strandings in New Brunswick in 2005; and 13 animals in 8 stranding events on Sable Island, Nova Scotia in 1970-1998 (Reeves and Whitehead 1997; Hooker *et al.* 1997; Lucas and Hooker 2000). Sex was recorded for 11 of the 13 Sable island animals, and all were male, which is consistent with sperm whale distribution patterns (Lucas and Hooker 2000).

Mass strandings have been reported in many oceanic regions (Rice ~~et al~~*et al*. 1986; Kompanje and Reumer 1995; Evans ~~et al~~*et al*. 2002; Fujiwara ~~et al~~*et al*. 2007; Pierce ~~et al~~*et al*. 2007; Mazzariol ~~et al~~*et al*. 2011). Reasons for the strandings are unknown, although multiple causes (e.g., topography, changes in geomagnetic field, solar cycles, ship strikes, global changes in water temperature and prey distribution, and pollution) have been suggested (Kirschvink ~~et al~~*et al*. 1986; Brabyn and Frew 1994; Holsbeek *et al.* 1999; Mazzariol ~~et al~~*et al*. 2011).

Ship strikes are another source of human-caused~~-induced~~ mortality (McGillivary ~~et al~~*et al*. 2009; Carrillo and Ritter 2010). In May 1994 a ship-struck sperm whale was observed south of Nova Scotia (Reeves and Whitehead 1997); in May 2000 a merchant ship reported a strike in Block Canyon; in 2001 the U.S. Navy reported a ship strike within the EEZ (NMFS, unpublished data). In 2006, a sperm whale was found dead from ship strike wounds off Portland, Maine. In spring, the Block Canyon region is part of a major pathway for sperm whales entering southern New England continental shelf waters in pursuit of migrating squid (CETAP 1982; Scott and Sadove 1997).

~~Using stranding and entanglement data, during 2006-2010, one sperm whale was confirmed struck by a ship, thus, there is an annual average of 0.2 sperm whales per year struck by ships.~~

STATUS OF STOCK

This is a strategic stock because the species is listed as endangered under the ESA. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR, and therefore can be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP in U.S. Atlantic EEZ is unknown. There are insufficient data to determine population trends. The current stock abundance estimate was based upon a small portion of the known stock range. A Recovery Plan for sperm whales was finalized in 2010 (NMFS 2010).

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April 2013~~April 2012~~

DWARF SPERM WHALE (*Kogia sima*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The dwarf sperm whale (*Kogia sima*) ~~appears to be~~is distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989; McAlpine 2002). Sightings of these animals in the western North Atlantic occur in oceanic waters (Figure 1; Mullin and Fulling 2003; NMFS unpublished data)~~, although there are no stranding records for the east Canadian coast (Willis and Baird 1998)~~. Stranding records exist from Florida to Maine, but there are no stranding records for the east Canadian coast (Willis and Baird 1998). Dwarf sperm whales and pygmy sperm whales (*K. breviceps*) are difficult to differentiate at sea (Caldwell and Caldwell 1989, Wursig *et al.* 2000), and sightings of either species are often categorized as *Kogia* sp. Diagnostic morphological characters have been useful in distinguishing the two *Kogia* species (Barros and Duffield 2003), thus enabling researchers to use stranding data in distributional and ecological studies. Specifically, the distance from the snout to the center of the blowhole in proportion to the animal's total length, as well as the height of the dorsal fin in proportion to the animal's total length, can be used to differentiate between the two *Kogia* species when such measurements are obtainable (Barros and Duffield 2003; Handley 1966). Duffield *et al.* (2003) proposed using the molecular weights of myoglobin and hemoglobin, as determined by blood or muscle tissues of stranded animals, as a quick and robust way to provide species confirmation.

Using hematological as well as stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. This behavior may result in differential exposure to marine debris, collision with vessels and other anthropogenic activities between the two *Kogia* species.

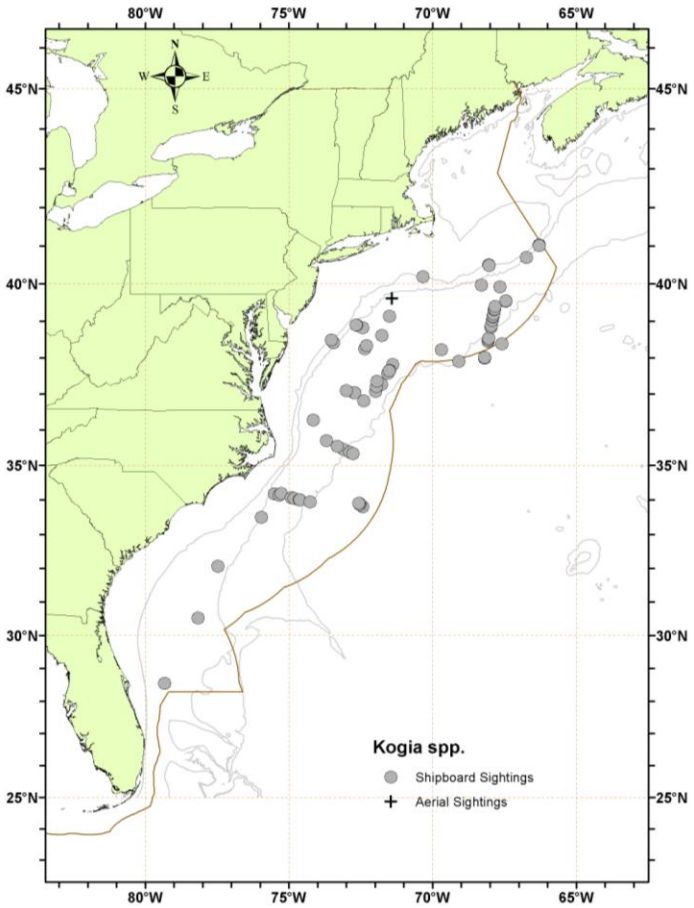

Figure 1. *Distribution of* Kogia *spp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers in 2004 and 2011. Isobaths are the ~~at~~ 100-~~-~~m, 1,000-~~-~~m and 4,000- m depth contours.*

The western North Atlantic ~~*Kogia* sp.~~dwarf sperm whale population is ~~provisionally~~ being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

Abundance estimates from selected regions of the dwarf sperm whale habitat exist for select time periods. Because *K. sima* and *K. breviceps* are difficult to differentiate at sea, the reported abundance estimates ~~prior to the 2011 estimate~~ are for both species of *Kogia*. ~~The best abundance estimate for dwarf sperm whales is the result of the 2011 survey~~ The best estimate for *Kogia* spp. is 3,785 (CV=0.47; Table 1)~~1,042 (CV=0.65)~~. This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. This estimate is almost certainly negatively biased. One component of line transect estimates is *g(0)*, the probability of seeing an animal on the transect line. Estimating *g(0)* is difficult because it consists of accounting for both perception bias (i.e., at the surface but missed) and availability bias (i.e., below the surface while in range of the observers), and many uncertainties (e.g., group size and diving behavior) can confound both (Marsh and Sinclair 1989; Barlow 1999). The best estimate was corrected for perception bias (see below) but not availability bias and a corrected estimate could be 2-4 times larger.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

~~An abundance estimate of 358 (CV= 0.44) for *Kogia* sp. was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (about 38° N) to the Bay of Fundy (about 45° N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥ 50 m) between 27.5 – 38 ºN latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias *g(0)* and group size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al*. 2001). The resulting abundance estimate for *Kogia* sp. between Florida and Maryland was 37 animals (CV=0.75).~~

~~An abundance estimate of 1,042 (CV=0.65) dwarf sperm whales was generated from a shipboard and aerial survey conducted during June – August 2011. The aerial portion covered 6850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour through the US and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the US EEZ). The abundance estimates of dwarf sperm whales include a percentage of the estimate of animals identified as *Kogia* sp. (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified dwarf sperm whales to the total of positively identified pygmy sperm whales and positively identified dwarf sperm whales; the CV of the abundance estimate includes the variance of the estimated fraction. Both sighting platforms used a two simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al*. 2009).~~ In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida). ~~The abundance estimates from this southern survey are being calculated and are not available at this time.~~ An abundance estimate of 1,783 (CV=0.62) *Kogia* spp. was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay

of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al*. 2009).

An abundance estimate of 2,002 (CV=0.69) *Kogia* spp. was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic *Kogia* spp.[a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Aug 2004~~	~~Maryland to Bay of Fundy~~	~~358~~	~~0.44~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~37~~	~~0.75~~
~~Jun-Aug 2004~~	~~Bay of Fundy to Florida (COMBINED)~~	~~395~~	~~0.40~~
Jun-Aug 2011	~~North Carolina~~central Virginia to lower Bay of Fundy	~~1,042~~1,783	0.62~~5~~
Jun-Aug 2011	central Florida to central Virginia	2,002	0.69
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	3,785	0.47

~~a. 201[a] 2011 estimates are for dwarf sperm whales alone, not the *Kogia* sp.~~

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Kogia* spp. is 3,785 (CV=0.47).~~dwarf sperm whales is 1,042 (CV=0.65)~~ The minimum population estimate for *Kogia* spp. is 2,598 animals~~dwarf sperm whales is 632 animals~~.

Current Population Trend

~~The available information is insufficient to evaluate population trends for this species in the western North Atlantic.~~A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for ~~dwarf sperm whales~~*Kogia* spp. is 2,598~~632~~. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for ~~the~~ western North Atlantic *Kogia* spp. is 26~~dwarf sperm whales is 6.3~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury for *Kogia* sp. during 2007-2011 was 3.4 (CV=1.0; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

The commercial fishery that could potentially interact with this stock in the Atlantic Ocean is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery.~~Detailed fishery information is reported in Appendix III.~~ Total estimated annual ~~estimated~~ average fishery-related mortality and serious injury ~~to these stocks~~ during 2007-2011~~2006-2010~~ was unknown~~zero~~ for dwarf sperm whales because species-specific mortality estimates could not be made. ~~, as~~ However, there was 1 report of a *Kogia* sp. seriously injured by the pelagic longline fishery during quarter 4 of 2011. Estimated serious injuries of *Kogia* sp. attributable to the pelagic longline fishery in the mid-Atlantic Bight region during quarter 4 of 2011 were 17.0 (CV=1.0; Garrison and Stokes 2012). The annual average serious injury and mortality attributable to the Atlantic pelagic longline fishery for the 5-year period from 2007 to 2011 was 3.4 animals (CV=1.0; Table 2).~~were no reports of mortality or serious injury to this species.~~

Table 2. Summary of the incidental mortality and serious injury of Atlantic Ocean *Kogia* sp. by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels [a]	Data Type [b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	07-11	74,78, 75,79, 83	Obs. Data Logbook	.07, .07, .10, .08, .09	0,0,0,0,1	0,0,0,0,0	0,0,0,0,17	0,0,0,0,0	0,0,0,0,17	NA, NA, NA, NA, 1.00	3.4 (1.0)
TOTAL											3.4 (1.0)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).

Earlier Interactions

–Between 1992 and 2006~~5~~, 1 *Kogia* sp. was hooked, released alive and considered seriously injured in 2000 (in the Florida East coast fishing area) (Yeung 2001).

Other Mortality

~~From 2006-2010, 32~~From 2007-2011, at least 35 dwarf sperm whales were reported stranded along the U.S. Atlantic coast and Puerto Rico (Table 3~~2~~; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 (SER) and 9 November 2012 (NER)). In addition, there were 6~~5~~ records of unidentified stranded *Kogia*.

~~Table 2. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2006-2010. Strandings which were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.~~

~~STATE~~	~~2006~~			~~2007~~			~~2008~~			~~2009~~			~~2010~~			~~TOTALS~~		
	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~
~~Maine~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~
~~Massachusetts~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~2~~	~~0~~	~~1~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~6~~	~~1~~
~~Rhode Island~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~
~~New York~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~5~~	~~0~~
~~New Jersey~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~5~~	~~0~~
~~Delaware~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~
~~Maryland~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Virginia~~	~~0~~	~~1~~	~~0~~	~~0~~	~~6~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~2~~	~~7~~	~~2~~
~~North Carolina~~	~~8~~	~~7~~	~~0~~	~~7~~	~~5~~	~~0~~	~~1~~	~~4~~	~~1~~	~~1~~	~~6~~	~~0~~	~~3~~	~~5~~	~~0~~	~~20~~	~~27~~	~~1~~
~~South Carolina~~	~~0~~	~~1~~	~~0~~	~~1~~	~~3~~	~~0~~	~~0~~	~~5~~	~~0~~	~~1~~	~~6~~	~~0~~	~~1~~	~~6~~	~~0~~	~~3~~	~~21~~	~~0~~
~~Georgia~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~10~~	~~0~~
~~Florida~~	~~1~~	~~2~~	~~0~~	~~1~~	~~5~~	~~0~~	~~2~~	~~5~~	~~0~~	~~0~~	~~6~~	~~0~~	~~2~~	~~17~~	~~1~~	~~6~~	~~35~~	~~1~~
~~Puerto Rico~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~
~~TOTALS~~	~~9~~	~~18~~	~~0~~	~~9~~	~~27~~	~~1~~	~~5~~	~~20~~	~~1~~	~~3~~	~~26~~	~~0~~	~~6~~	~~36~~	~~3~~	~~32~~	~~127~~	~~5~~

Table 3. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2007-2011. Strandings that were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.

STATE	**2007**			**2008**			**2009**			**2010**			**2011**			**TOTALS**		
	Ks	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**
Maine	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0
Massachusetts	0	1	1	0	2	0	1	4	0	1	0	0	0	0	0	2	7	1
New York	0	1	0	0	0	0	0	1	0	0	2	0	0	1	0	0	5	0
New Jersey	0	1	0	0	1	0	0	2	0	0	3	0	1	1	0	1	8	0
Delaware	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Maryland	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Virginia	2	4	0	2	0	0	0	0	0	0	0	2	1	1	0	5	5	2

North Carolina	5	7	0	1	4	1	1	6	0	3	5	0	2	10	0	12	32	1
South Carolina	1	3	0	0	5	0	1	6	0	1	6	0	1	2	0	4	22	0
Georgia	0	1	0	0	3	0	0	2	0	0	2	1	0	4	0	0	12	1
Florida	1	5	0	3	6	0	1	6	0	3	17	0	2	14	1	10	48	1
Puerto Rico	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0
TOTALS	9	27	1	6	21	1	4	28	0	8	36	3	8	34	1	35	146	6

There ~~was~~were three~~one~~ documented strandings of ~~a~~ dwarf sperm whales along the U.S. Atlantic coast during 2007-2011~~2006-2010~~ ~~which~~ that ~~was~~were classified as ~~a~~ human interactions. ~~This was a 2006 Florida mortality that was classified as a fishery interaction.~~ ~~There~~One was a 2007 stranding in Virginia that was classified as a fishery interaction. ~~Also,Another~~The second was a whale stranded in Florida during 2010 whose flukes were cut off by a public person on the beach. Finally, plastic was found in the stomach of an animal that stranded in New Jersey during 2011.

Historical stranding records (1883-1988) of dwarf sperm whales in the southeastern U.S. (Credle 1988), and strandings recorded during 1988-1997 (Barros *et al.* 1998) indicate that this species accounts for about 17% of all *Kogia* strandings in the entire southeastern U.S. waters. During the period 1990-October 1998, 3 dwarf sperm whale strandings occurred in the northeastern U.S. (Maryland, Massachusetts, and Rhode Island), whereas 43 strandings were documented along the U.S. Atlantic coast between North Carolina and the Florida Keys in the same period. ~~A pair of latex examination gloves was retrieved from the stomach of a dwarf sperm whale stranded in Miami in 1987 (Barros *et al.* 1990). In the period 1987-1994, 1 animal had possible propeller cuts on or near the flukes.~~

~~A mid-Atlantic Offshore Small Cetacean Unusual Mortality Event (UME), was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Fifteen pygmy sperm whales (*Kogia breviceps*) and one dwarf sperm whale (*Kogia sima*) were involved in this UME. Two pygmy sperm whales were involved in a multispecies UME in North Carolina in January of 2005 (Hohn *et al.* 2006). Although anthropogenic noise was not definitively implicated, the January 2005 event was associated in time and space with naval sonar activity. Potential risk to this species and others from anthropogenic noise is of concern.~~

Stranding data probably underestimate the extent of ~~fishery~~human-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other ~~fishery~~ human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interactions.

Rehabilitation challenges for *Kogia* sp. are numerous due to limited knowledge regarding even the basic biology of these species. Advances in recent rehabilitation success ~~has~~have potential implications for future release and tracking of animals at sea to potentially provide information on distribution, movements and habitat use of these species (Manire *et al.* 2004).

STATUS OF STOCK

Dwarf sperm whales are not listed as threatened or endangered under the Endangered Species Act, and the ~~The~~ western North Atlantic stock ~~of dwarf sperm whales~~ is not ~~a~~considered strategic under the ~~U.S. MMPA~~Marine Mammal Protection Act. ~~stock because the average annual human-related mortality and serious injury rate does not exceed the PBR.~~ Total U.S. fishery-related mortality and serious injury for ~~this stock~~*Kogia* sp. is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of dwarf sperm whales ~~relative to OSP~~ in the western U.S. Atlantic EEZ relative to OSP is unknown. There are insufficient data to determine population trends for this species. ~~This species is not listed as endangered or threatened under the Endangered Species Act.~~

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PYGMY SPERM WHALE (*Kogia breviceps*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy sperm whale (*Kogia breviceps*) ~~appears to be~~is distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989; McAlpine 2002). Sightings of these animals in the western North Atlantic occur in oceanic waters (Figure 1; Mullin and Fulling 2003; SEFSC unpublished data).~~, although~~ Stranding records exist from Florida to Maine, but there are no stranding records for the east Canadian coast (Willis and Baird 1998). Pygmy sperm whales and dwarf sperm whales (*K. sima*) are difficult to differentiate at sea (Caldwell and Caldwell 1989, Wursig *et al.* 2000), and sightings of either species are often categorized as *Kogia* sp. Diagnostic morphological characters have been useful in distinguishing the two *Kogia* species (Barros and Duffield 2003; Handley 1966), thus enabling researchers to use stranding data in distributional and ecological studies. Specifically, the distance from the snout to the center of the blowhole in proportion to the animal's total length, as well as the height of the dorsal fin in proportion to the animal's total length, can be used to differentiate between the two *Kogia* species when such measurements are obtainable (Barros and Duffield 2003). Duffield *et al.* (2003) propose using the molecular weights of myoglobin and hemoglobin, as determined by blood or muscle tissues of stranded animals, as a quick and robust way to provide species confirmation.

Using hematological as well as stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. This behavior may result in differential exposure to marine debris, collision with vessels and other anthropogenic activities between the two *Kogia* species.

The western North Atlantic ~~*Kogia* sp.~~pygmy sperm whale population is ~~provisionally~~ being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

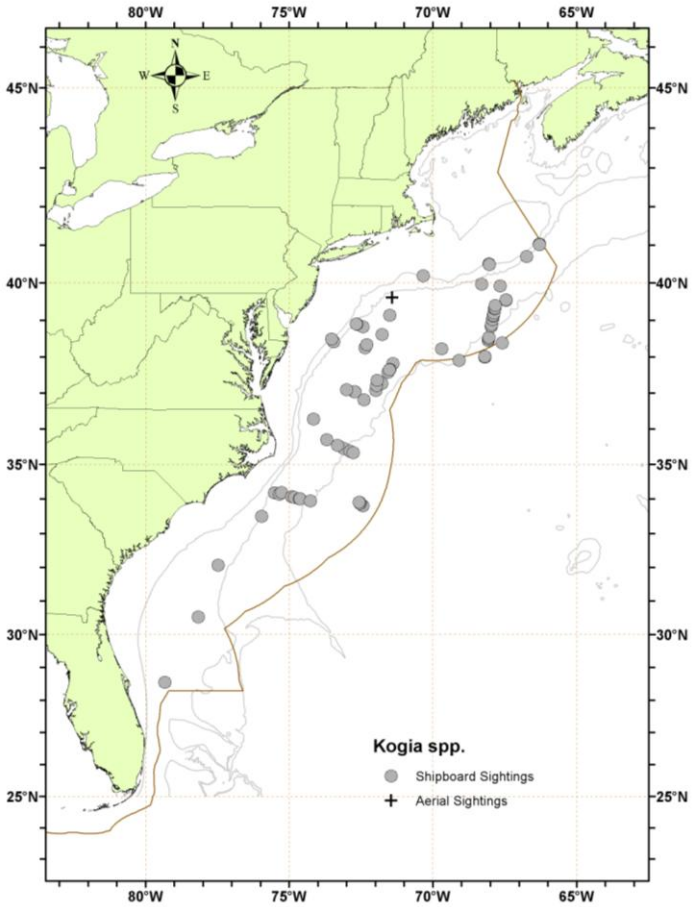

Figure 1. *Distribution of* Kogia *spp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers in 2004 and 2011. Isobaths are the ~~at~~ 100-m, 1,000-m and 4,000-m depth contours.*

POPULATION SIZE

Total numbers of pygmy sperm whales off the U.S. ~~or~~and Canadian Atlantic coast are unknown, although estimates from selected regions of the habitat do exist for select time periods. Because *K.~~ogia~~ breviceps* and *K.~~ogia~~ sima* are difficult to differentiate at sea, the reported abundance estimates ~~prior to the 2011 estimate~~ are for both

species of *Kogia*. The best abundance estimate for ~~pygmy sperm whales~~*Kogia* spp. is ~~the result of the 2011 survey – 3,785 (CV=0.47; Table 1)741 (CV=0.40)~~. This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. This estimate is almost certainly negatively biased. One component of line transect estimates is *g(0)*, the probability of seeing an animal on the transect line. Estimating *g(0)* is difficult because it consists of accounting for both perception bias (i.e., at the surface but missed) and availability bias (i.e., below the surface while in range of the observers), and many uncertainties (e.g., group size and diving behavior) can confound both (Marsh and Sinclair 1989; Barlow 1999). The best estimate was corrected for perception bias (see below) but not availability bias and a corrected estimate could be 2-4 times larger.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

~~An abundance estimate of 358 (CV= 0.44) *Kogia* sp. was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38° N) to the Bay of Fundy (45° N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥ 50 m) between 27.5 and 38 ºN latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias *g(0)* and group size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al*. 2001). The resulting abundance estimate for *Kogia* sp. between Florida and Maryland was 37 animals (CV=0.75).~~

~~An abundance estimate of 741 (CV=0.40) pygmy sperm whales was generated from a shipboard and aerial survey conducted during June-August 2011. The aerial portion covered 6,850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the US EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al*. 2009). The abundance estimates of pygmy sperm whales include a percentage of the estimate of animals identified as *Kogia* sp. (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified pygmy sperm whales to the total of positively identified pygmy sperm whales and positively identified dwarf sperm whales; the CV of the abundance estimate includes the variance of the estimated fraction. In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~ An abundance estimate of 1,783 (CV=0.62) *Kogia* spp. was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance

sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 2,002 (CV=0.69) *Kogia* spp. was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic *Kogia* spp. [a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to Bay of Fundy	358	0.44
Jun-Aug 2004	Florida to Maryland	37	0.75
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	395	0.40
Jun-Aug 2011	North Carolinacentral Virginia to lower Bay of Fundy	7411,783	0.6240
Jun-Aug 2011	central Florida to central Virginia	2,002	0.69
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	3,785	0.47

[a]. 2011 estimates are for pygmy sperm whales alone, not the *Kogia* sp.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Kogia* spp. is 3,785 (CV=0.47)pygmy sperm whales is 741 animals (CV=0.40). The minimum population estimate for *Kogia* spp. is 2,598 animalspygmy sperm whales is 535 animals.

Current Population Trend

The available information is insufficient to evaluate population trends for this species in the western North Atlantic.A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for pygmy sperm whales.*Kogia* spp. is 2,598535. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of

unknown status. PBR for ~~the~~ western North Atlantic *Kogia* spp. is 26~~pygmy sperm whales is 5.4~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury for *Kogia* sp. during 2007-2011 was 3.4 (CV=1.0; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

~~Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to these stocks during 2006-2010 was zero for pygmy sperm whales, as there were no reports of mortality or serious injury to this species.~~The commercial fishery that could potentially interact with this stock in the Atlantic Ocean is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery. Total estimated annual average fishery-related mortality and serious injury during 2007-2011 was unknown for pygmy sperm whales because species-specific mortality estimates could not be made. However, there was 1 report of a *Kogia* sp. seriously injured by the pelagic longline fishery during quarter 4 of 2011. Estimated serious injuries of *Kogia* attributable to the pelagic longline fishery in the mid-Atlantic Bight region during quarter 4 of 2011 were 17.0 (CV=1.0; Garrison and Stokes 2012).**Error! Bookmark not defined.** The annual average serious injury and mortality for *Kogia* sp. attributable to the Atlantic pelagic longline fishery for the 5-year period from 2007 to 2011 was 3.4 animals (CV=1.0; Table 2).

Table 2. Summary of the incidental mortality and serious injury of Atlantic Ocean *Kogia* sp. by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels [a]	Data Type [b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	07-11	74,78, 75,79, 83	Obs. Data Logbook	.07, .07, .10, .08, .09	0,0,0,0,1	0,0,0,0,0	0,0,0,0,17	0,0,0,0,0	0,0,0,0,17	NA, NA, NA, NA, 1.00	3.4 (1.0)
TOTAL											3.4 (1.0)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).

Earlier Interactions

Between 1992 and 2006~~5~~, 1 *Kogia* sp. was hooked, released alive and considered seriously injured in the pelagic longline fishery in the Atlantic in 2000 (Yeung 2001).

Other Mortality

From 2007~~6~~-2011~~0~~, at least ~~127~~146 pygmy sperm whales ~~were reported~~ stranded along the U.S. Atlantic coast and Puerto Rico (Table 3~~2~~; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 (SER) and 9 November 2012 (NER)). In addition, there were 6~~5~~ records of unidentified *Kogia*.

~~Table 2. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2006-2010. Strandings which were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.~~

~~STATE~~	~~2006~~			~~2007~~			~~2008~~			~~2009~~			~~2010~~			~~TOTALS~~		
	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~	~~Ks~~	~~Kb~~	~~Sp~~
~~Maine~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~
~~Massachusetts~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~2~~	~~0~~	~~1~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~6~~	~~1~~
~~Rhode Island~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~
~~New York~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~5~~	~~0~~
~~New Jersey~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~5~~	~~0~~
~~Delaware~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~
~~Maryland~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Virginia~~	~~0~~	~~1~~	~~0~~	~~0~~	~~6~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~2~~	~~7~~	~~2~~
~~North Carolina~~	~~8~~	~~7~~	~~0~~	~~7~~	~~5~~	~~0~~	~~1~~	~~4~~	~~1~~	~~1~~	~~6~~	~~0~~	~~3~~	~~5~~	~~0~~	~~20~~	~~27~~	~~1~~
~~South Carolina~~	~~0~~	~~1~~	~~0~~	~~1~~	~~3~~	~~0~~	~~0~~	~~5~~	~~0~~	~~1~~	~~6~~	~~0~~	~~1~~	~~6~~	~~0~~	~~3~~	~~21~~	~~0~~
~~Georgia~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~10~~	~~0~~
~~Florida~~	~~1~~	~~2~~	~~0~~	~~1~~	~~5~~	~~0~~	~~2~~	~~5~~	~~0~~	~~0~~	~~6~~	~~0~~	~~2~~	~~17~~	~~1~~	~~6~~	~~35~~	~~1~~
~~Puerto Rico~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~
~~TOTALS~~	~~9~~	~~18~~	~~0~~	~~9~~	~~27~~	~~1~~	~~5~~	~~20~~	~~1~~	~~3~~	~~26~~	~~0~~	~~6~~	~~36~~	~~3~~	~~32~~	~~127~~	~~5~~

~~A mid-Atlantic Offshore Small Cetacean UME, was declared when 33 small cetaceans stranded from Maryland to Georgia between July 2004 and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Fifteen pygmy sperm whales and one dwarf sperm whale were involved in this UME. Two pygmy sperm whales were involved in a multispecies UME in North Carolina in January of 2005 (Hohn *et al.* 2006). Although anthropogenic noise was not definitively implicated, the January 2005 event was associated in time and space with naval sonar activity. Potential risk to this species and others from anthropogenic noise is of concern.~~

Table 3. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2007-2011. Strandings that were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.

STATE	**2007**			**2008**			**2009**			**2010**			**2011**			**TOTALS**		
	Ks	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**	**Ks**	**Kb**	**Sp**
Maine	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	3	0
Massachusetts	0	1	1	0	2	0	1	4	0	1	0	0	0	0	0	2	7	1
New York	0	1	0	0	0	0	0	1	0	0	2	0	0	1	0	0	5	0

New Jersey	0	1	0	0	1	0	0	2	0	0	3	0	1	1	0	1	8	0
Delaware	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0
Maryland	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
Virginia	2	4	0	2	0	0	0	0	0	0	0	2	1	1	0	5	5	2
North Carolina	5	7	0	1	4	1	1	6	0	3	5	0	2	10	0	12	32	1
South Carolina	1	3	0	0	5	0	1	6	0	1	6	0	1	2	0	4	22	0
Georgia	0	1	0	0	3	0	0	2	0	0	2	1	0	4	0	0	12	1
Florida	1	5	0	3	6	0	1	6	0	3	17	0	2	14	1	10	48	1
Puerto Rico	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	1	0
TOTALS	9	27	1	6	21	1	4	28	0	8	36	3	8	34	1	35	146	6

There were ~~16~~17 documented strandings of pygmy sperm whales along the U.S. Atlantic coast during 2007~~6~~-2011~~0~~ which were classified as human interactions. ~~In 2006, mortalites in Maine, North Carolina and Rhode Island (1 each) were classified as human interactions.~~ In Massachusetts in 2007, a pygmy sperm whale was classified as a human interaction because it was pushed off the beach. The animal was last seen swimming with its mother. Two other human interaction cases were documented in 2007—~~one~~1 in South Carolina and ~~one~~1 ~~(fishery interaction)~~ in Virginia (both plastic ingestion). In 2008, ~~one~~1 animal in Georgia was classified as a human interaction (plastic ingestion). In 2009, there was a fishery interaction stranding mortality in Massachusetts and a human interaction in South Carolina (plastic ingestion). There were 7 strandings classified as human interactions in 2010—3 in Florida, 2 in New Jersey and 2 in South Carolina (~~one~~1 of them classified as a fishery interaction due to ingested fishing gear, 5 animals ingested plastic, and 1 carcass had some teeth removed by public). In 2011, there were 4 strandings classified as human interactions - 1 in Virginia (public attempted to move the animal), 1 in Florida (pushed out to sea by public) and 2 in Georgia (plastic ingestion).

Historical stranding records (1883-1988) of pygmy sperm whales in the southeastern U.S. (Credle 1988) and strandings recorded during 1988-1997 (Barros *et al.* 1998) indicate that this species accounts for about 83% of all *Kogia* sp. strandings in this area. During the period 1990-October 1998, 21 pygmy sperm whale strandings occurred in the northeastern U.S. (Delaware, New Jersey, New York and Virginia), whereas 194 strandings were documented along the U.S. Atlantic coast between North Carolina and the Florida Keys in the same period. ~~Remains of plastic bags and other marine debris have been retrieved from the stomachs of 13 stranded pygmy sperm whales in the southeastern U.S. (Barros *et al.* 1990, 1998), and at least on one occasion the ingestion of plastic debris is believed to have been the cause of death. During the period 1987-1994, 1 animal had possible propeller cuts on its flukes.~~

Stranding data probably underestimate the extent of ~~fishery~~human-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other ~~fishery~~human- interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interactions.

Rehabilitation challenges for *Kogia* sp. are numerous due to limited knowledge regarding even the basic biology of these species. Advances in recent rehabilitation success has potential implications for future release and tracking of animals at sea to potentially provide information on distribution, movements and habitat use of these species (Manire *et al.* 2004).

STATUS OF STOCK

Pygmy sperm whales are not listed as threatened or endangered under the Endangered Species Act, and the~~The~~ western North Atlantic stock ~~of pygmy sperm whales~~ is not ~~a~~considered strategic under the ~~U.S. MMPA~~Marine Mammal Protection Act~~stock because the average annual human-related mortality and serious injury rate does not exceed the PBR~~. Total U.S. fishery-related mortality and serious injury for ~~this stock~~*Kogia* sp. is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of pygmy sperm whales ~~relative to OSP~~ in the western U.S. Atlantic EEZ relative to OSP is unknown. There are insufficient data to determine population trends for this species. ~~This species is not listed as endangered or threatened under the Endangered Species Act.~~

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CUVIER'S BEAKED WHALE (*Ziphius cavirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of Cuvier's beaked whales is poorly known, and is based mainly on stranding records (Leatherwood *et al.* 1976). Strandings have been reported from Nova Scotia along the eastern U.S. coast south to Florida, around the Gulf of Mexico, and within the Caribbean (Leatherwood *et al.* 1976; CETAP 1982; Heyning 1989; Houston 1990; MacLeod *et al.* 2006; Jefferson *et al.* 2008). Stock structure in the North Atlantic is unknown.

Cuvier's beaked whale sightings have occurred principally along the continental shelf edge in the Mid-Atlantic region off the northeast U.S. coast (CETAP 1982; Waring *et al.* 1992; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring or summer.

POPULATION SIZE

Estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006) as well as ~~one~~ two estimates of Cuvier's beaked whales alone. Survey platform type influences observer ability to identify species, with differentiation most difficult from aircraft, but o~~O~~bservers have gained experience at distinguishing between species of beaked whales, enabling a single species estimate in some cases. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Cuvier's beaked whales is ~~result~~ the sum of the 2011 surveys ~~4,962~~6,532 (CV=0.~~37~~32).

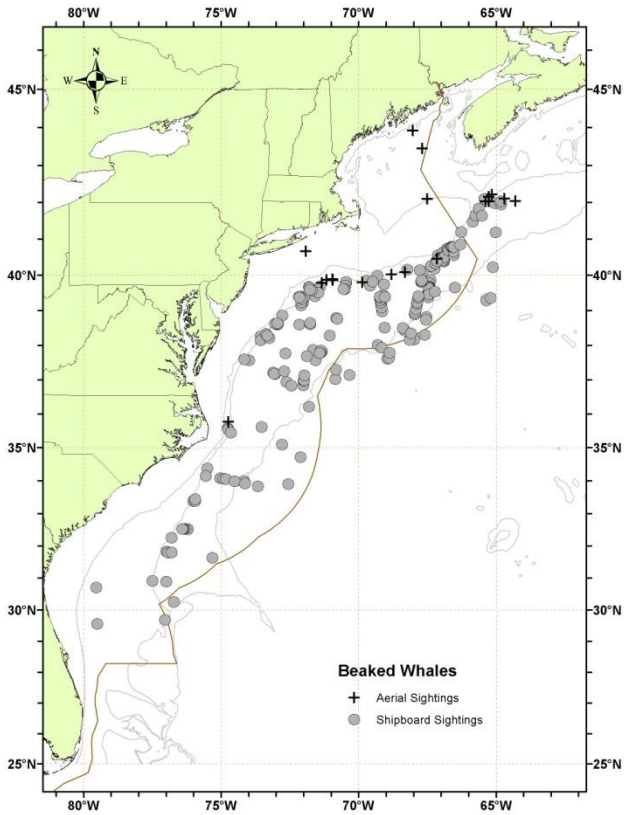

Figure 1. *Distribution of beaked whale sightings (includes Ziphius and Mesoplodon spp.) from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006 and, 2007, 2008, 2010and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, and should not be used for PBR determinations. Further, ~~due to changes in survey methodology these data should not be used to make comparisons to more current estimates~~Due to changes in survey methodology, these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

~~An abundance of 2,839 (CV=0.78) for beaked whales was estimated from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1: Palka 2006). Shipboard data were collected using the two independent team- line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001),~~

~~and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June–August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf-break and Gulf Stream front in the Mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf-break. Data were corrected for visibility bias *g(0)* and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for undifferentiated? beaked whales between Florida and Maryland was 674 animals (CV =0.36).~~

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales (*Ziphius* and *Mesoplodon* spp.) was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An abundance estimate of 4,962 (CV=0.37) Cuvier's beaked whales (not including *Mesoplodon* spp.~~?~~) was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a ~~two-simultaneous-team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). ~~In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida. The abundance estimates from this southern survey are being calculated and are not available at this time.~~

~~A 2011 abundance survey was also conducted in the southern U.S. waters.~~ An abundance estimate of 1,570 (CV=0.65) Cuvier's beaked whales (not including *Mesoplodon* spp.~~?~~) was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Although the 1990-2011 surveys did not sample exactly the same areas or encompass the entire beaked whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990-2011 data suggest that, seasonally, at least several thousand beaked whales (undifferentiated) are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al.* 2001; Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that ~~*Mesoplodon* spp.~~beaked whales prefer~~s~~ deep-water habitats (Mead 1989) the bias may be substantial.

Table 1. Summary of abundance estimates for Ziphius[a] or the undifferentiated complex [a]-[b] of beaked whales which include *Ziphius* and *Mesoplodon* spp. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~2,839~~	~~0.78~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~674~~	~~0.36~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~3,513~~	~~0.63~~
Aug 2006[b]	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jul-Aug 2011[a]	~~North Carolina~~Central Virginia to lower Bay of Fundy	4,962	0.37
a. ~~a.~~ 2011estimates are for Cuvier's beaked whales alone, not the undifferentiated complex. b. 2006 estimate includes *Mesoplodon* and *Ziphius.*			

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Cuvier's beaked whales (not including *Mesoplodon* spp.) is ~~4,962~~6,532 (CV=~~0.37~~0.32). The minimum population estimate for Cuvier's beaked whales (not including *Mesoplodon* spp.) is ~~3,670~~5,021.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~is There are insufficient data to determine population trends for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity is 6.1m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mitchell 1975; Mead 1984; Houston 1990).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for Cuvier's beaked whales is ~~3,670~~5,021. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5. PBR for Cuvier's beaked whales is ~~37~~50.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The ~~2006~~2007-~~2010~~ 2011 –minimum –annual rate of human-caused mortality of Cuvier's beaked whales averaged 0.4 animals per year. This is from two stranding records that showed signs of human interaction (1 fishery and 1 vessel strike) (Table 3).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Total annual estimated average fishery-related mortality or serious injury of this stock in ~~2006~~2007-~~2010~~ 2011 in U.S. observed fisheries was ~~zero~~0.2 due to one stranding record of a Cuvier's beaked whale with fishing net in its GI tract. Detailed fishery information is reported in Appendix III.

Earlier Interactions

There is no historical information available that documents incidental mortality of beaked whales in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch prior to 2003 of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October. Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included 24 Sowerby's, 4 True's, 1 Cuvier's and 17 undifferentiated beaked whales. Recent analyses of biological samples (genetics and morphological analysis) have been used to determine species identifications for some of the bycaught animals. Estimated bycatch mortality by species is available for the 1994-1998 period. Prior estimates are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). The 1994-1998 estimates for Cuvier's beaked whales are 1 in 1994 (0.14) and zero for the years 1995-1996 and 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

Pelagic Longline

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions have been ~~were~~ reported since 2003.~~prior to 2003 or in 2005-2010~~2011~~. The annual average combined mortality and serious injury in 2006~~2007-2010~~ 2011 was zero Cuvier's beaked whales.~~

Other Mortality

During ~~2006~~2007-~~2010~~-2011 ~~eight~~ nine Cuvier's beaked whales stranded along the U.S. Atlantic coast (Table ~~3~~2). Two animals showed evidence of human interaction.

Several unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities (Cox *et al.* 2006; D'Amico ~~et al~~*et al*. 2009; Fernandez *et al.* 2005; Filadelfo ~~et al~~*et al*. 2009). During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998; D'Amico ~~et al~~*et al*. 2009; Filadelfo ~~et al~~*et al*. 2009). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; NMFS 2001; Cox *et al.* 2006). Four Cuvier's, 2 Blainville's and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsies of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.* 2006). Fourteen beaked

whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005). ~~Twenty-seven beaked whales (mostly Cuvier's beaked whales but also Sowerby's and unidentified beaked whales) stranded along the coasts of the UK and Ireland from January July 2008 (Dolman et al*et al.* 2010). In addition, a mother/calf pair live stranded at Calais, France in January. However, given the advanced state of decomposition of the majority of the carcasses, no information was available to ascertain the causes of this unusual mortality event (Dolman et al*et al.* 2010).~~

Table 2. Cuvier's beaked whale (*Ziphius cavirostris*) strandings along the U.S. Atlantic coast.

State	2007	2008	2009	2010	2011	Total
New Jersey[a]	0	1	0	0	0	**1**
South Carolina[b]	1	0	0	0	0	**1**
Georgia	0	1	0	0	0	**1**
Florida	2	1	0	0	3	**6**
Total	**3**	**3**	**0**	**0**	**3**	**9**

a. Animal in New Jersey in 2008 had fishing net and a wood fragment found in the GI tract.
b. Animal in South Carolina in 2007 displayed signs of having been involved in a boat collision.

~~Table 3. Cuvier's beaked whale (*Ziphius cavirostris*) strandings along the U.S. Atlantic coast.~~

~~State~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~Total~~
~~Massachusetts~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~New Jersey[a]~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~
~~Georgia~~	~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~
~~South Carolina[b]~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~
~~Florida~~	~~0~~	~~2~~	~~1~~	~~0~~	~~0~~	~~3~~
~~**Total**~~	~~**2**~~	~~**3**~~	~~**3**~~	~~**0**~~	~~**0**~~	~~**8**~~

~~a. Animal in New Jersey in 2008 had fishing net and a wood fragment found in the GI tract.~~
~~b. Animal in South Carolina in 2007 displayed signs of having been involved in a boat collision.~~

STATUS OF STOCK

Cuvier's bealed whales are not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. ~~The western North Atlantic stock of Cuvier's beaked whale is not a strategic stock because a~~Average annual human-related mortality and serious injury does not exceed PBR. The total U.S. fishery mortality and serious injury for this group of species is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of Cuvier's beaked whale relative to OSP in the U.S. Atlantic EEZ is unknown. ~~This species is not listed as threatened or endangered under the Endangered Species Act.~~

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BLAINVILLE'S BEAKED WHALE (*Mesoplodon densirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the genus Mesoplodon, there are four species of beaked whales that reside in the northwest Atlantic. These include True's beaked whale, *M. mirus*; Gervais' beaked whale, *M. europaeus*; Blainville's beaked whale, *M. densirostris*; and Sowerby's beaked whale, *M. bidens* (Mead 1989). These species are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. Stock structure for each species is unknown. ~~Therefore~~Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding *et al.* 2007).

The distributions of *Mesoplodon* spp. in the northwest Atlantic ~~is~~ are known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006; Jefferson *et al.* 2008). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

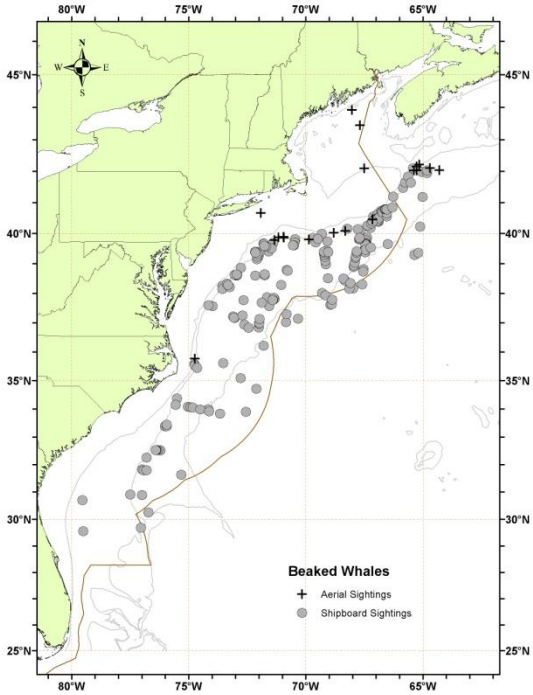

Figure 1~~:~~. *Distribution of beaked whale (includes Ziphius and Mesoplodon spp.) sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, and 2007, 2008, 2010, and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Blainville's beaked whales have been reported from southwestern Nova Scotia to Florida, and are believed to be widely but sparsely distributed (Leatherwood *et al.* 1976; Mead 1989; Nicolas *et al.* 1993; MacLeod *et al.* 2006; Jefferson *et al.* 2008). There are two records of strandings in Nova Scotia which probably represent strays from the Gulf Stream (Mead 1989). They are considered rare in Canadian waters (Houston 1990).

POPULATION SIZE

The total number of Blainville's beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown, and seasonal abundance estimates are not available for this stock. However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006) as well as two estimates of *Mesoplodon* spp. beaked whales alone. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for *Mesoplodon* spp. beaked whales is the sum of the 2011 survey estimates – 7,092 (CV=0.54).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~Due to changes in survey methodology these data should not be used to make comparisons to more current estimates~~Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

An abundance of 2,839 (CV=0.78) for beaked whales was estimated from a line transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and g(0), the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle back line transect method (Hiby 1999) and analyzed accounting for g(0) and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group size bias and analyzed using line transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36).

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales (*Ziphius* and *Mesoplodon* spp.) was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.).

An abundance estimate of 5,500 (CV=0.67) *Mesoplodon* spp. (not including *Ziphius*) beaked whales was generated from No beaked whales sighted during a shipboard and aerial abundance survey conducted during June-August 2011 were identified as Blainville's beaked whales (Palka 2012). aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). The aerial portion covered 5,313 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.

A 2011 abundance survey was also conducted in the southern U.S. waters. An abundance estimate of 1,570 (CV=0.65) *Mesoplodon* spp. (not including *Ziphius*) beaked whales was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).also

Although the 1990-2011 surveys did not sample exactly the same areas or encompass the entire beaked whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990-2011 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS survey results suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001, Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefer deep-water habitats (Mead 1989), the bias may be substantial.

Table 1. Summary of abundance estimates for *Mesoplodon* spp.[a] or the undifferentiated complex[b] of beaked whales which include *Ziphius* and *Mesoplodon* spp. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~2,839~~	~~0.78~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~674~~	~~0.36~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~3,513~~	~~0.63~~
Aug 2006[b]	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jun-Aug 2011[a]	Central Virginia to lower Bay of Fundy	5,500	0.67
Jun-Aug 2011 [a]	Central Florida to Central Virginia	1,592	0.67
Jun-Aug 2011 [a]	Central Florida to lower Bay of Fundy (COMBINED)	7,092	0.54

[a] 2011estimates are for *Mesoplodon* spp. beaked whales alone.
[b] 2006 estimate includes *Mesoplodon* and *Ziphius.*

~~[a] 2011estimates are for *Mesoplodon* spp. beaked whales alone.~~
~~[b] 2006 estimate includes *Mesoplodon* and *Ziphius.*~~

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp. beaked whales (not including *Ziphius*) is 7,092 (CV=0.54). ~~The~~ The minimum population estimate for *Mesoplodon* spp. beaked whales (not including *Ziphius*)~~for Gervais' beaked whales is~~ is 4,632. ~~Present data are insufficient to calculate a minimum population estimate for this stock.~~

Current Population Trend

~~There are insufficient data to determine population trends for these species.~~ A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon* spp. life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity 6.1 m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mead 1984).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the

constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for *Mesoplodon* spp.~~the undifferentiated complex of~~ beaked whales (not including *Ziphius*) is 4,632~~2,154~~. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5. PBR for the western North Atlantic stock of *Mesoplodon* spp.~~Blainville's~~ beaked whales is ~~unknown because the minimum population size is unknown~~46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The ~~2006~~2007~~–2010~~ 2011 total average estimated annual mortality of Blainville's beaked whales in fisheries in the U.S. Atlantic EEZ is 0.2 based on one stranded animal likely killed in 2007 by fishery entanglement (Table 3).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Estimated annual average fishery-related mortality or serious injury of this stock in ~~2006~~2007~~–~~2010~~1~~1 in U.S. fisheries was ~~zero~~0.2.

Earlier Interactions

There is no historical information available that documents incidental mortality in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch prior to 2003 of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October (Northridge 1996). Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included: 24 Sowerby's; 4 True's; 1 Cuvier's; and 17 undifferentiated beaked whales. Recent analysis of biological samples (genetics and morphological analysis) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). Estimates of bycatch mortality by species are available for the 1994~~–~~1998 period. None of the animals were identified as Blainville's beaked whales. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in the U.S. Atlantic pelagic longline fishery in 2003 was 5.3 beaked whales (CV=1.0). ~~N~~No serious injury or mortality interactions have been ~~were~~ reported since 2003. ~~prior to 2003 or in 2004 – 2010~~2011~~. The estimated average combined mortality in 2006~~2007~~ 2010 2011 was zero beaked whales.~~

Other Mortality

From ~~2006~~2007~~–2010~~2011, a total of 4 Blainville's beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). One animal in 2007 that stranded in South Carolina was classified as a fishery interaction~~)~~.

Several unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities (D'Amico *et al.* 2009; Filadelfo *et al.* 2009). During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998; D'Amico *et al.* 2009; Filadelfo *et al.* 2009). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; NMFS 2001; Cox *et al.* 2006). Four Cuvier's, 2 Blainville's, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsy of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.* 2006).

~~-~~Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005). ~~Twenty-seven beaked whales (mostly Cuvier's beaked whales but also Sowerby's and unidentified beaked whales) stranded along the coasts of the UK and Ireland from January-July 2008 (Dolman et al*et al*. 2010). In addition, a mother/calf pair live stranded at Calais, France in January. However, given the advanced state of decomposition of the majority of the carcasses, no information was available to ascertain the causes of this unusual mortality event (Dolman et al*et al*. 2010).~~

Table 2. Blainville's beaked whale (*Mesoplodon densirostris*) strandings along the U.S. Atlantic coast.

State	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
North Carolina	1	1	0	0	0	**2**
South Carolina[a]	1	0	0	0	0	**1**
Florida	0	0	0	0	1	**1**
Total	**2**	**1**	**0**	**0**	**1**	**4**

a. Animal in South Carolina in 2007 is classified as a fishery interaction due to entanglement marks around its peduncle.

~~Table 2. Blainville's beaked whale (*Mesoplodon densirostris*) strandings along the U.S. Atlantic coast.~~

~~**State**~~	~~**2006**~~	~~**2007**~~	~~**2008**~~	~~**2009**~~	~~**2010**~~	~~**Total**~~
~~North Carolina~~	~~1~~	~~1~~	~~1~~	~~0~~	~~0~~	~~**3**~~
~~South Carolina[a]~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~**1**~~
~~**Total**~~	~~**1**~~	~~**2**~~	~~**1**~~	~~**0**~~	~~**0**~~	~~**4**~~

~~a. Animal in South Carolina in 2007 is classified as a fishery interaction due to entanglement marks around its peduncle.~~

STATUS OF STOCK

Blainville's beaked whales are ~~This species is~~ not listed as threatened or endangered under the Endangered Species Act~~.~~T and the western North Atlantic stock of Blainville's beaked whale is not ~~a strategic stock~~considered strategic under the Marine Mammal Protection Act. There are insufficient data to determine the population size or trends, and, while a PBR value has been calculated for the *Mesoplodon* genus, PBR cannot be calculated for this ~~stock~~species independently. The permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and a single 2007 stranding record was the only fishery-related mortality and serious injury observed during the recent 5-year (~~2006~~2007-~~2010~~2011) period. Therefore, total U.S. fishery-related mortality and serious injury rate can be considered to be insignificant and approaching zero. The status of Blainville's beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. ~~This species is not listed as threatened or endangered under the Endangered Species Act.~~

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GERVAIS' BEAKED WHALE (*Mesoplodon europaeus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the genus *Mesoplodon*, there are four species of beaked whales that reside in the northwest Atlantic. These include True's beaked whale, *Mesoplodon mirus*; Gervais' beaked whale, *M. europaeus*; Blainville's beaked whale, *M. densirostris*; and Sowerby's beaked whale, *M. bidens* (Mead 1989). These species are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. Stock structure for each species is unknown. ~~Therefore~~Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding ~~et al~~*et al*. 2007).

The distribution of *Mesoplodon* spp. in the northwest Atlantic is known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006; Jefferson ~~et al~~*et al*. 2008). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

Gervais' beaked whales are believed to be principally oceanic, and strandings have been reported from Cape Cod ~~Bay~~ to Florida, into the Caribbean and the Gulf of Mexico (NMFS unpublished data; Leatherwood *et al.* 1976; Mead 1989; Moore *et al.* 2005; MacLeod *et al.* 2006; Jefferson ~~et al~~*et al*. 2008). This is the most common species of *Mesoplodon* to strand along the U.S. Atlantic coast. ~~The northernmost stranding was on Cape Cod (Moore *et al.* 2005).~~

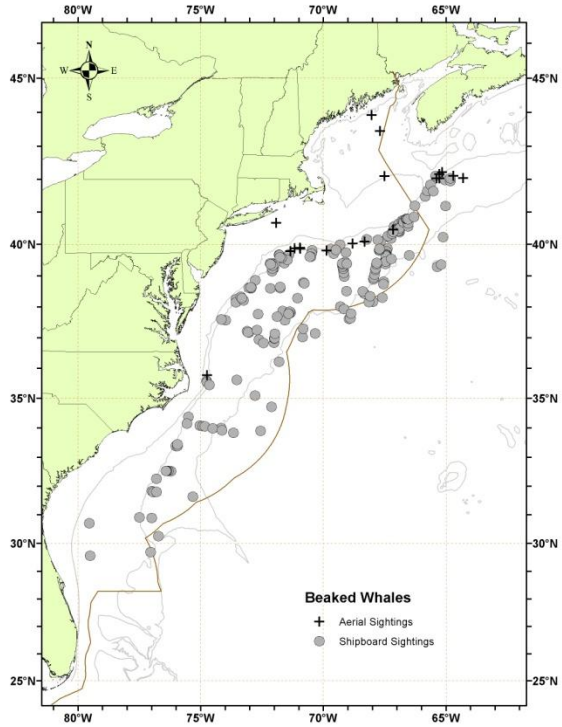

Figure 1~~:~~. *Distribution of beaked whale (includes Ziphius and Mesoplodon spp.) sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, and 2007, 2008, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

POPULATION SIZE

~~——~~The total number of Gervais' beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown. Survey platform type influences observer ability to identify species, with differentiation most difficult from aircraft. However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006), as well as ~~one~~ two estimates of *Mesoplodon* spp.~~Gervais'~~ beaked whales alone. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for *Mesoplodon* spp.~~Gervais'~~ beaked whales is the ~~result~~ sum of the 2011 survey estimates – ~~1,847~~7,092 (CV=0.~~96~~54).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~Due to changes in survey methodology these data should not be used to make comparisons to more current estimates~~Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

~~An abundance of 2,839 (CV=0.78) for beaked whales was estimated from a line transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of trackline in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf stream front in the Mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36).~~

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales (*Ziphius* and *Mesoplodon* spp.) was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An abundance estimate of ~~1,945~~5,500 (CV=~~1.00~~0.67) *Mesoplodon* spp.~~Gervais'~~ beaked whales (not including *Ziphius*) was generated from a shipboard and aerial survey conducted during June~~–~~–August 2011(Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,017 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a ~~two-simultaneous team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). ~~The abundance estimate includes a percentage of the estimate of animals identified as *Mesoplodon* spp. The percentage used is the ratio of positively identified Gervais' beaked whales to the total of positively identified Sowerby's beaked whales and positively identified Gervais' beaked whales; the CV of the abundance estimate includes the variance of the estimated fraction. In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida, The abundance estimates from this southern survey are being calculated and are not available at this time.~~

~~A 2011 abundance survey was also conducted in the southern U.S. waters.~~ An abundance estimate of 1,570 (CV=0.65) *Mesoplodon* spp. beaked whales (not including *Ziphius*) was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). ~~also~~

Although the 1990-2011 surveys did not sample exactly the same areas or encompass the entire beaked whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990-2011 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys suggest that beaked whale

abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001; Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefers deep-water habitats (Mead 1989) the bias may be substantial.

Table 1. Summary of abundance estimates for *Mesoplodon* spp.[a] or the undifferentiated complex[b] of beaked whales which include *Ziphius* and *Mesoplodon* spp.[a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~2,839~~	~~0.78~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~674~~	~~0.36~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~3,513~~	~~0.63~~
Aug 2006[b]	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jun-Aug 2011[a]	~~North Carolina~~Central Virginia to lower Bay of Fundy	~~1,847~~5,500	~~0.96~~0.67
Jun-Aug 2011[a]	Central Florida to Central Virginia	1,592	0.67
Jun-Aug 2011[a]	Central Florida to lower Bay of Fundy (COMBINED)	7,092	0.54

[a] 2011estimates are for *Mesoplodon* spp. beaked whales alone.
[b] 2006 estimate includes *Mesoplodon* and *Ziphius.*

~~[a] 2011estimates are for *Mesoplodon* spp.Gervais' beaked whales alone, not the undifferentiated complex.~~
~~[b] 2006 estimate includes *Mesoplodon* and *Ziphius.*~~

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp. (not including *Ziphius*)~~Gervais'~~ beaked whales is ~~1,847~~7,092 (CV=~~0.96~~0.54). The minimum population estimate for *Mesoplodon* spp.~~Gervais'~~ beaked whales (not including *Ziphius*) is ~~935~~4,632.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~There are insufficient data to determine population trends for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon spp.* life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity 6.1 m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mead 1984).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for *Mesoplodon* spp.~~Gervais~~ beaked whales is ~~935~~4,632. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5. PBR for *Mesoplodon* spp.~~Gervais~~ beaked whales (not including *Ziphius*) is ~~9.4~~46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The ~~2006~~2007-~~2010~~-2011 total average estimated annual mortality of Gervais' beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Estimated annual average fishery-related mortality or serious injury of this stock in ~~2006~~2007–~~2010~~-2011 in U.S. fisheries was zero. Detailed fishery information is reported in Appendix III.

Earlier Interactions

There is no historical information available that documents incidental mortality in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch prior to 2003 of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October (Northridge 1996). Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included: 24 Sowerby's; 4 True's; 1 Cuvier's; and 17 undifferentiated beaked whales. Recent analysis of biological samples (genetics and morphological analysis) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). Estimates of bycatch mortality by species are available for the 1994–1998 period, although none of the animals were identified as Gervais' beaked whales. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions have been ~~were~~ reported since 2003.~~prior to 2003 or in 2004 – 2010. The annual average combined mortality and serious injury in 2006~~2007 2010 2011 was zero beaked whales.~~

Other Mortality

During ~~2006~~2007–~~2010~~2011, ~~17~~ 21 Gervais' beaked whales stranded along the U.S. Atlantic coast (Table 2). None of these animals displayed signs of human interaction.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with naval activities (D'Amico ~~et al~~*et al*. 2009; Filadelfo ~~et al~~*et al*. 2009. During the mid- to late 1980's multiple

mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 was associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998; A'Amico ~~et al~~*et al*. 2009; Filadelfo ~~et al~~*et al*. 2009). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; NMFS 2001; Cox *et al.* 2006). Four Cuvier's, 2 Blainville's, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsy of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.* 2006). Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005). ~~Twenty-seven beaked whales (mostly Cuvier's beaked whales but also Sowerby's and unidentified beaked whales) stranded along the coasts of the UK and Ireland from January–July 2008 (Dolman et al~~*et al*~~. 2010). In addition, a mother/calf pair live stranded at Calais, France in January. However, given the advanced state of decomposition of the majority of the carcasses, no information was available to ascertain the causes of this unusual mortality event (Dolman et al~~*et al*~~. 2010).~~

Table 3. Gervais' beaked whale (*Mesoplodon europaeus*) strandings along the U.S. Atlantic coast.

State	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
New Jersey	0	1	0	1	0	**2**
Maryland	0	0	1	1	0	**2**
Virginia	1	0	1	1	0	**3**
North Carolina	1	0	1	1	2	**5**
South Carolina	0	0	0	0	1	**1**
Georgia	0	0	0	1	0	**1**
Florida	1	2	2	1	1	**7**
Total	**3**	**3**	**5**	**6**	**4**	**21**

~~Table 3. Gervais' beaked whale (*Mesoplodon europaeus*) strandings along the U.S. Atlantic coast.~~

~~**State**~~	~~**2006**~~	~~**2007**~~	~~**2008**~~	~~**2009**~~	~~**2010**~~	~~**Total**~~
~~New Jersey~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~	~~**2**~~
~~Maryland~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~	~~**2**~~
~~Virginia~~	~~0~~	~~1~~	~~0~~	~~1~~	~~1~~	~~**3**~~
~~North Carolina~~	~~0~~	~~1~~	~~0~~	~~1~~	~~1~~	~~**3**~~
~~Georgia~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~**1**~~
~~Florida~~	~~0~~	~~1~~	~~2~~	~~2~~	~~1~~	~~**6**~~
~~**Total**~~	~~**0**~~	~~**3**~~	~~**3**~~	~~**5**~~	~~**6**~~	~~**17**~~

STATUS OF STOCK

Gervais' beaked whales are~~This species is~~ not listed as threatened or endangered under the Endangered Species Act.~~T~~ and the western North Atlantic stock of Gervais' beaked whale is not ~~a~~ considered strategic ~~stock~~under the Marine Mammal Protection Act. There are insufficient data to determine the population size or trends, and, while a PBR value has been calculated for the *Mesoplodon* genus, PBR cannot be calculated for this species independently. The permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and no fishery-related mortality and serious injury has been observed during the recent 5-year (2007–2011) period.~~because average annual human-related mortality and serious injury does not exceed PBR.~~ Therefore, the total U.S. fishery mortality and serious injury ~~for this group of species is less than 10% of the calculated PBR and~~rate~~, therefore,~~ can be considered to be insignificant and approaching zero~~ mortality and serious injury rate~~. The status of Gervais' beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. ~~This species is not listed as threatened or endangered under the Endangered Species Act.~~

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SOWERBY'S BEAKED WHALE (*Mesoplodon bidens*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the genus *Mesoplodon*, there are four species of beaked whales that reside in the northwest Atlantic. These include True's beaked whale, *M. mirus*; Gervais' beaked whale, *M. europaeus*; Blainville's beaked whale, *M. densirostris*; and Sowerby's beaked whale, *M. bidens* (Mead 1989). These species are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. Stock structure for each species is unknown. ~~Therefore~~Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding ~~et al~~*et al*. 2007).

The distributions of *Mesoplodon* spp. in the northwest Atlantic ~~is~~ are known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006). Off the U.S. Atlantic coast, beaked whale (~~*Ziphius* and~~ *Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

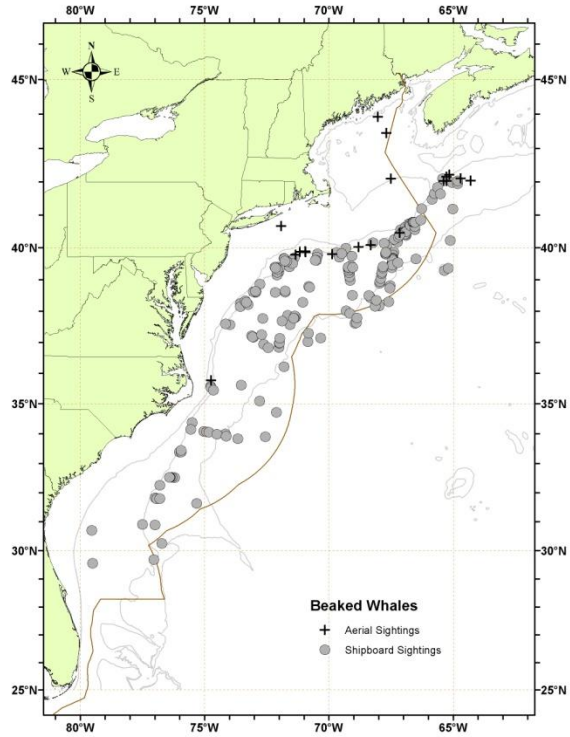

Figure 1: *Distribution of beaked whale (includes Ziphius and Mesoplodon spp.) sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Sowerby's beaked whales have been reported from New England waters north to the ice pack (e.g., Davis Strait), and individuals are seen along the Newfoundland coast in summer (Leatherwood *et al.* 1976; Mead 1989; MacLeod *et al.* 2006; Jefferson ~~et al~~*et al*. 2008). Furthermore, a single stranding occurred off the Florida west coast (Mead 1989). This species is considered rare in Canadian waters (Lien *et al.* 1990) and has been designated as "Special Concern" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

POPULATION SIZE

Several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006), as well as ~~one~~ two estimates of *Mesoplodon* spp.~~Sowerby's~~ beaked whales alone. Survey platform type influences observer ability to identify species, with differentiation most difficult from aircraft. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for *Mesoplodon* spp.~~Sowerby's~~ beaked whales is the ~~result~~ sum of the 2011 survey estimates ~~3,653~~7,092 (CV=~~0.69~~0.54).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~Due to changes in survey methodology these data should not be used to make comparisons to more current estimates~~Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

~~An abundance of 2,839 (CV=0.78) for beaked whales was estimated from a line transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and g(0), the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle back line transect method (Hiby 1999) and analyzed accounting for g(0) and biases due to school size and other potential covariates (Palka 2005).~~

~~A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June–August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf stream front in the Mid Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group size bias and analyzed using line transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36).~~

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales (~~including~~ *Ziphius*~~?~~ and *Mesoplodon* spp.) was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.)

An abundance estimate of 5,500 ~~3,653~~ (CV=~~0.69~~0.67) *Mesoplodon* spp.~~Sowerby's~~ beaked whales (not including *Ziphius*~~?~~) was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of ~~North Carolina~~Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). ~~The abundance estimate includes a percentage of the estimate of animals identified as *Mesoplodon* spp. The percentage used is the ratio of positively identified Sowerby's beaked whales to the total of positively identified Sowerby's beaked whales and positively identified Gervais' beaked whales; the CV of the abundance estimate includes the variance of the estimated fraction.~~ Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). ~~In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~

~~A 2011 abundance survey was also conducted in the southern U.S. waters.~~ An abundance estimate of 1,570 (CV=0.65) *Mesoplodon* spp. beaked whales (not including *Ziphius*~~?~~) was also generated from a shipboard survey conducted during June–August 2011 between central Florida and Virginia. The survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of survey effort were accomplished with 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Although the 1990–2011 surveys did not sample exactly the same areas or encompass the entire beaked whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990–2011 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al.* 2001;

Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefer~~s~~ deep-water habitats (Mead 1989) the bias may be substantial.

Table 1. Summary of abundance estimates for *Mesoplodon* spp.[a] or the undifferentiated complex[b] of beaked whales which include *Ziphius* and *Mesoplodon* spp.[a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~2,839~~	~~0.78~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~674~~	~~0.36~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~3,513~~	~~0.63~~
Aug 2006[b]	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jun-Aug 2011[a]~~Jun-Aug 2011[a]~~	Central Virginia to lower Bay of Fundy~~North Carolina to lower Bay of Fundy~~	5,500~~3,653~~	0.67~~0.69~~
Jun-Aug 2011 [a]	Central Florida to Central Virginia	1,592	0.67
Jun-Aug 2011 [a]	Central Florida to lower Bay of Fundy (COMBINED)	7,092	0.54

[a] 2011estimates are for *Mesoplodon* spp.~~Sowerby's~~ beaked whales alone, not the undifferentiated complex
[b]2006 estimate includes *Mesoplodon* and *Ziphius.*

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp.~~Sowerby's~~ beaked whales (not including *Ziphius*) ~~–~~is ~~3,653~~7,092 (CV=~~0.69~~0.54). ~~, and the~~The minimum population estimate for *Mesoplodon* spp beaked whales is ~~2,160~~4,632.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~There are insufficient data to determine population trends for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon* spp. life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity 6.1 m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mead 1984).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the *Mesoplodon* spp.~~undifferentiated complex of~~ beaked whales is 4,632~~2,160~~. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5. -PBR for *Mesoplodon* spp.~~Sowerby's~~ beaked whales (not including *Ziphius*) -is ~~22~~46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The ~~2006~~2007–201~~0~~1 ~~–~~total average estimated annual mortality of~~–~~ Sowerby's beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). ~~-~~NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". ~~–~~Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Estimated annual average fishery-related mortality or serious injury of this stock in ~~2006~~2007~~–2010~~–2011 in U.S. fisheries was zero. Detailed fishery information is reported in Appendix III.

Earlier Interactions

There is no historical information available that documents incidental mortality in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch prior to 2003 of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October (Northridge 1996). Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included: 24 Sowerby's; 4 True's; 1 Cuvier's; and 17 undifferentiated beaked whales. Recent analysis of biological samples (genetics and morphological analysis) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). Estimates of bycatch mortality by species are available for the 1994-1998 period. For animals identified as Sowerby's beaked whales, bycatch estimates were 3 (0.09) in 1994, 6 (0) in 1995, 9 (0.12) in 1996 and 2 (0) in 1998. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions have been ~~were~~ reported since ~~prior to~~ 2003. ~~or in 2004 – 2010. The estimated average combined mortality in 2006–2010 was zero beaked whales.~~

Other Mortality

During ~~2006~~2007~~–2010~~–2011 three Sowerby's beaked whales stranded along the U.S. Atlantic coast (Table 3). None of these animals showed evidence of a human interaction.

Several unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities (D'Amico ~~et al~~*et al*. 2009; Filadelfo ~~et al~~*et al*. 2009). During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998; D'Amico ~~et al~~*et al*. 2009; Filadelfo ~~et al~~*et al*. 2009). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; NMFS 2001; Cox *et al.* 2006). Four Cuvier's, 2 Blainville's, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsy of 6 dead beaked

whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.* 2006).. Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005). ~~Twenty-seven beaked whales (mostly Cuvier's beaked whales but also Sowerby's and unidentified beaked whales) stranded along the coasts of the UK and Ireland from January-July 2008 (Dolman et al*et al*. 2010). In addition, a mother/calf pair live stranded at Calais, France in January. However, given the advanced state of decomposition of the majority of the carcasses, no information was available to ascertain the causes of this unusual mortality event (Dolman et al*et al*. 2010).~~

Table 3. Sowerby's beaked whale (*Mesoplodon bidens*) strandings along the U.S. Atlantic coast.						
State	**2007**	**2008**	**2009**	**2010**	**2011**	**Total**
Rhode Island	1	0	0	0	0	**1**
Virginia	0	0	2	0	0	**2**
Total	1	0	2	0	0	**3**

~~Table 3. Sowerby's beaked whale (*Mesoplodon bidens*) strandings along the U.S. Atlantic coast.~~						
~~**State**~~	~~**2006**~~	~~**2007**~~	~~**2008**~~	~~**2009**~~	~~**2010**~~	~~**Total**~~
~~Rhode Island~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~**1**~~
~~Virginia~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~**2**~~
~~Total~~	~~0~~	~~1~~	~~0~~	~~2~~	~~0~~	~~**3**~~

STATUS OF STOCK

While Sowerby's beaked whales are not listed as threatened or endangered under the Endangered Species Act they have been listed as a species of Special Concern by both COSEWIC and SARA (the Species at Risk Act) in Canada (COSEWIC 2006). The western North Atlantic stock of Sowerby's beaked whale is not ~~a strategic stock~~considered strategic under the Marine Mammal Protection Act. There are insufficient data to determine the population size or trends, and, while a PBR value has been calculated for the *Mesoplodon* genus, PBR cannot be calculated for this species independently. The permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and no fishery-related mortality and serious injury has been observed during the recent 5-year (2007–2011) period. ~~because average annual human-related mortality and serious injury does not exceed PBR.~~ Therefore, t~~T~~he total U.S. fishery mortality and serious injury ~~for this group of species is less than 10% of the calculated PBR and, therefore,~~ rate can be considered to be insignificant and approaching zero~~ mortality and serious injury rate~~. The status of Sowerby's beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. ~~This While this species is not listed as threatened or endangered under the Endangered Species Act it has been listed as a species of Special Concern by both COSEWIC and SARA (the Species at Risk Act) in Canada (COSEWIC 2006).~~

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TRUE'S BEAKED WHALE (*Mesoplodon mirus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the genus *Mesoplodon*, there are four species of beaked whales that reside in the northwest Atlantic. These include True's beaked whale, *M. mirus*; Gervais' beaked whale, *M. europaeus*; Blainville's beaked whale, *M. densirostris*; and Sowerby's beaked whale, *M. bidens* (Mead 1989). These species are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. Stock structure for each species is unknown. ~~Therefore~~Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding *et al.* 2007).

The distributions of *Mesoplodon* spp. in the northwest Atlantic ~~is~~ are known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006; Jefferson *et al.* 2008). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

True's beaked whale is a temperate-water species that has been reported from Cape Breton Island, Nova Scotia, to the Bahamas (Leatherwood *et al.* 1976; Mead 1989; MacLeod *et al.* 2006; Jefferson *et al.* 2008). It is considered rare in Canadian waters (Houston 1990).

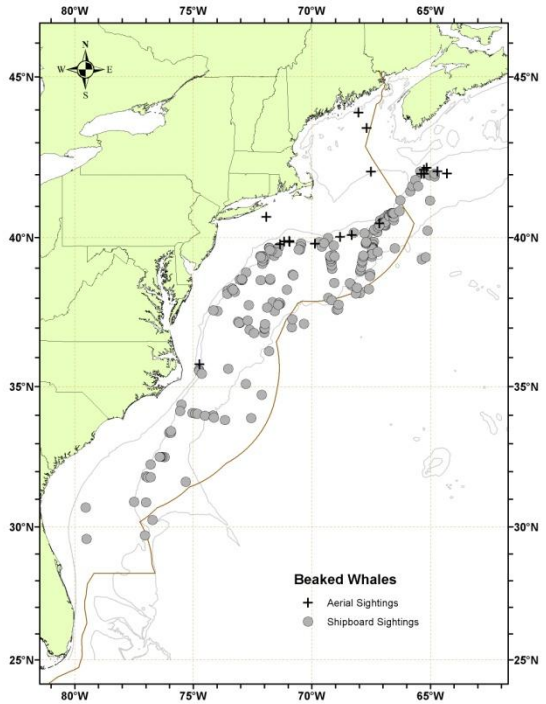

Figure 1: *Distribution of beaked whale (includes Ziphius and Mesoplodon spp.) sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

POPULATION SIZE

The total number of True's beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown, and seasonal abundance estimates are not available for this stock. However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006) as well as two estimates of *Mesoplodon* spp. beaked whales alone. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for *Mesoplodon* spp. beaked whales is the sum of the 2011 survey estimates – 7,092 (CV=0.54).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~Due to changes in survey methodology these data should not be used to make comparisons to more current estimates~~Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

~~An abundance of 2,839 (CV=0.78) for beaked whales was estimated from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and g(0), the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle back line-transect method (Hiby 1999) and analyzed accounting for g(0) and biases due to school size and other potential covariates (Palka 2005).~~

~~A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36).~~

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence~~.~~ (Table 1; Palka pers. comm.).

An abundance estimate of 5,500 (CV=0.67) *Mesoplodon* spp. beaked whales was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). ~~No beaked whales were identified as True's beaked whales during a shipboard and aerial abundance survey conducted during June-August 2011 (Palka 2012).~~ The aerial portion covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of ~~North Carolina~~central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a double-platform collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was an insignificant amount of responsive movement for this species, the estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

~~A 2011 abundance survey was also conducted in the southern U.S. waters.~~ An abundance estimate of 1,570 (CV=0.65) *Mesoplodon* spp. beaked whales was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).~~In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~

Although the 1990–2011 surveys did not sample exactly the same areas or encompass the entire beaked whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990–2011 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS survey results suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001, Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefer~~s~~ deep-water habitats (Mead 1989) the bias may be substantial.

Table 1. Summary of abundance estimates for *Mesoplodon* spp.[a] or the undifferentiated complex[b] of beaked whales which include *Ziphius* and *Mesoplodon* spp. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).			
Month/Year	Area	N_{best}	CV
~~Jun-Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~2,839~~	~~0.78~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~674~~	~~0.36~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~3,513~~	~~0.63~~
Aug 2006[b]	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jun-Aug 2011[a]	Central Virginia to lower Bay of Fundy	5,500	0.67
Jun-Aug 2011 [a]	Central Florida to Central Virginia	1,592	0.67
Jun-Aug 2011 [a]	Central Florida to lower Bay of Fundy (COMBINED)	7,092	0.54

[a] 2011estimates are for *Mesoplodon* spp. beaked whales alone.
[b] 2006 estimate includes *Mesoplodon* and *Ziphius.*

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp. beaked whales is 7,092 (CV=0.54). ~~. The~~ The minimum population estimate for *Mesoplodon* spp. beaked whales ~~for Gervais' beaked whales~~ is 4,632.~~Present data are insufficient to calculate a minimum population estimate for this stock.~~

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~There are insufficient data to determine population trends for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon* spp. life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3m, length at sexual maturity 6.1m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mead 1984).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for *Mesoplodon* spp ~~the undifferentiated complex of~~ beaked whales is ~~2,154~~4,632. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is

assumed to be 0.5. -PBR for the western North Atlantic stock of *Mesoplodon* spp~~True's~~ beaked whales is ~~unknown because the minimum population size is unknown~~46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The ~~2006~~2007 – ~~2010~~ 2011 total average estimated annual mortality of True's beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Estimated annual average fishery-related mortality or serious injury of this stock in ~~2006~~2007-~~2010~~ 2011 in U.S. fisheries was zero. Detailed fishery information is reported in Appendix III.

Earlier Interactions

There is no historical information available that documents incidental mortality in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch prior to 2003 of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October (Northridge 1996). Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included: 24 Sowerby's; 4 True's; 1 Cuvier's; and 17 undifferentiated beaked whales. Recent analysis of biological samples (genetics and morphological analysis) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). Estimates of bycatch mortality by species are available for the 1994-1998 period. For animals identified as True's beaked whales, bycatch estimates were 0 in 1994, 1 (0) in 1995, 2 (0.26) in 1996 and 2 (0) in 1998. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0,25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in the U.S. Atlantic pelagic longline fishery in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions have been ~~were~~ reported since ~~prior to~~ 2003.~~ or in 2004 – 2010. The estimated average combined mortality in 2006 – 2010 was zero beaked whales.~~

Other Mortality

During ~~2006~~2007 – ~~2010~~2011, ~~two~~ four True's beaked whales stranded along the U.S. Atlantic coast (Table 3). ~~Neither~~ None of these animals showed evidence of a human interaction.

Several unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities activities (D'Amico *et al.* 2009; Filadelfo *et al.* 2009. During the mid- to late 1980's multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998; A'Amico *et*

al. 2009; Filadelfo *et al.* 2009). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; NMFS 2001; Cox *et al.* 2006). Four Cuvier's, 2 Blainville's–, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsy of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.* 2006). Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005). Twenty-seven beaked whales (mostly Cuvier's beaked whales but also Sowerby's and unidentified beaked whales) stranded along the coasts of the UK and Ireland from January-July 2008 (Dolman et alet al. 2010). In addition, a mother/calf pair live stranded at Calais, France in January. However, given the advanced state of decomposition of the majority of the carcasses, no information was available to ascertain the causes of this unusual mortality event (Dolman et alet al. 2010).

Table 3. True's beaked whale (*Mesoplodon mirus*) strandings along the U.S. Atlantic coast.

State	2007	2008	2009	2010	2011	Total
New Jersey	1	0	0	0	0	**1**
New York	1	0	0	0	0	**1**
Maryland	0	0	0	0	1	**1**
North Carolina	0	0	0	0	1	**1**
Total	**2**	**0**	**0**	**0**	**2**	**4**

Table 3. True's beaked whale (*Mesoplodon mirus*) strandings along the U.S. Atlantic coast.

State	2006	2007	2008	2009	2010	Total
New Jersey	0	1	0	0	0	**1**
New York	0	1	0	0	0	**1**
Total	**0**	**2**	**0**	**0**	**0**	**2**

STATUS OF STOCK

This species isTrue's beaked whales are not listed as threatened or endangered under the Endangered Species Act. T and the western North Atlantic stock of True's beaked whale is not a strategic stockconsidered strategic under the Marine Mammal Protection Act. There are insufficient data to determine the population size or trends, and–, while a PBR value has been calculated for the *Mesoplodon* genus, PBR cannot be calculated for this stockspecies independently. The permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and no fishery-related mortality and serious injury has been observed during the recent 5-year (2006–2010) period. Therefore, total U.S. fishery-related mortality and serious injury rate can be considered to be insignificant and approaching zero. The status of True's beaked whales relative to OSP in

U.S. Atlantic EEZ is unknown. ~~This species is not listed as threatened or endangered under the Endangered Species Act.~~

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RISSO'S DOLPHIN (*Grampus griseus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphins are distributed worldwide in tropical and temperate seas (Jefferson ~~et al~~*et al*. 2008), and in the Northwest Atlantic occur from Florida to eastern Newfoundland (Leatherwood ~~et al~~*et al*. 1976; Baird and Stacey 1991). Off the northeast U.S. coast, Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and autumn (CETAP 1982; Payne ~~et al~~*et al*. 1984). In winter, the range is in the mid-Atlantic Bight and extends outward into oceanic waters (Payne ~~et al~~*et al*. 1984). In general, the population occupies the mid-Atlantic continental shelf edge year round, and is rarely seen in the Gulf of Maine (Payne ~~et al~~*et al*. 1984). During 1990, 1991 and 1993, spring/summer surveys conducted along the continental shelf edge and in deeper oceanic waters sighted Risso's dolphins associated with strong bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Waring ~~et al~~*et al*. 1992, 1993; Hamazaki 2002). There is no information on stock structure of Risso's dolphin in the western North Atlantic, or to determine if separate stocks exist in the Gulf of Mexico and Atlantic. ~~Therefore~~Thus, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Longhurst 1998; Spalding ~~et al~~*et al*. 2007). In 2006, a rehabilitated adult male Risso's dolphin stranded and released in the Gulf of Mexico off Florida was tracked via satellite-linked tag to waters off Delaware (Wells ~~et al~~*et al*. 2009). The Gulf of Mexico and Atlantic stocks are currently being treated as two separate stocks.

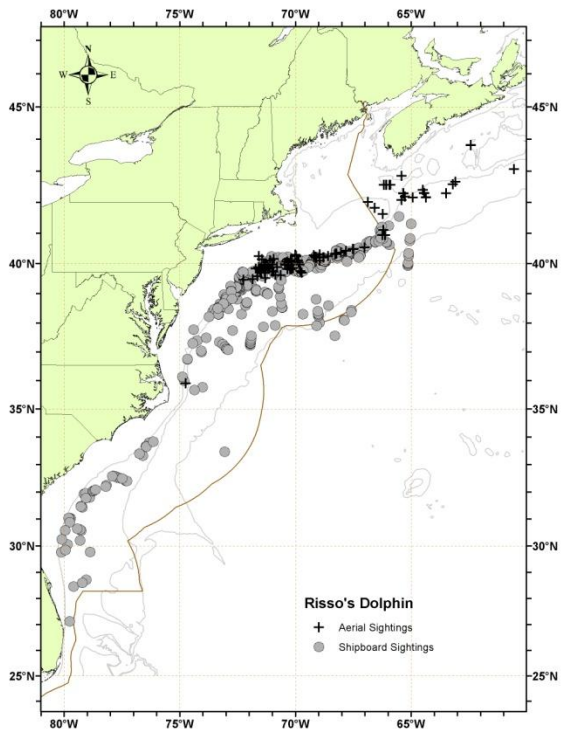

Figure 1. *Distribution of Risso's dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008 2010 and 2011. Isobaths are the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

Several~~Nine~~ abundance estimates are available for Risso's dolphins from selected regions for select time periods. Sightings were almost exclusively in continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Risso's dolphins is the ~~result~~ sum of the 2011 surveys— ~~15,197~~18,250 (CV=~~0.55~~0.46).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

~~An abundance estimate of 15,054 (CV=0.78) Risso's dolphins was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of trackline in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two-independent team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995)~~

~~accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001) , and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle back line transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and recorded a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were analyzed to correct for visibility bias (*g(0)*) and group-size bias employing line-transect distance analysis and the direct-duplicate estimator (Palka 1995; Buckland et al~~*et al*~~. 2001). The resulting abundance estimate for Risso's dolphins between Florida and Maryland was 5,426 (CV =0.54).~~

An abundance estimate of 14,408 (CV=0.38) Risso's dolphins was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2,000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka, pers. comm.). The value of g(0) used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 15,197~~7,734~~ (CV= 0.55~~42~~) Risso's dolphins was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of ~~North Carolina~~central Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a ~~two simultaneous team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Shipboard data were inspected to determine if there was significant responsive movement to the ship (Palka and Hammond 2001). Because there was evidence of responsive (evasive) movement of this species to the ship, estimation of the abundance was based on Palka and Hammond (2001) and the independent observer approach assuming full independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). ~~An abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~

An abundance estimate of 3,053 (CV=0.44) Risso's dolphins was ~~also also~~ generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology~~two independent visual teams~~ searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic Risso's dolphin (*Grampus griseus*). Month, year, and area covered during each abundance survey, resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV

~~Jun-Aug 2004~~	~~Maryland to Bay of Fundy~~	~~15,053~~	~~0.78~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~5,426~~	~~0.54~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~20,479~~	~~0.59~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	14,408	0.38
Jun-Aug 2011	~~North Carolina~~Central Virginia to lower Bay of Fundy	15,197	0.55
Jun-Aug 2011	Central Florida to Central Virginia	3,053	0.44
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	18,250	0.46

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Risso's dolphins is ~~15,197~~18,250 (CV=~~0..55~~0.46), obtained from the 2011 surveys. The minimum population estimate for the western North Atlantic Risso's dolphin is ~~9,857~~12,619.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

is~~There are insufficient data to determine population trends for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow ~~et al~~*et al*. 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~9.857~~12,619. The maximum productivity rate is 0.04, the default value for cetaceans (Barlow *et al.* 1995). The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3~~0.48 because the CV of the average mortality estimate is between 0.3 and 0.6~~ (Wade and Angliss 1997). PBR for the western North Atlantic stock of Risso's dolphin is ~~95~~126.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality or serious injury to this stock during ~~2006~~2007–~~2010~~ 2011 was ~~17~~ 62 Risso's dolphins (CV=~~0.51~~0.22; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year

period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet ~~(DWF)~~ activities off the northeast coast of the U.S. With implementation of the Fisheries Conservation and Management Act in that year, an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals. NMFS foreign-fishery observers reported four deaths of Risso's dolphins incidental to squid and mackerel fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring ~~et al~~*et al*. 1990; NMFS unpublished data).

In the pelagic drift gillnet fishery 51 Risso's dolphin mortalities were observed between 1989 and 1998. One animal was entangled and released alive. Bycatch occurred during July, September and October along continental shelf edge canyons off the southern New England coast. Estimated annual mortality and serious injury (CV in parentheses) attributable to the drift gillnet fishery was 87 in 1989 (0.52), 144 in 1990 (0.46), 21 in 1991 (0.55), 31 in 1992 (0.27), 14 in 1993 (0.42), 1.5 in 1994 (0.16), 6 in 1995 (0), 0 in 1996, no fishery in 1997, and 9 in 1998 (0). This fishery was closed effective in 1999.

In the pelagic pair trawl fishery, one mortality was observed in 1992. Estimated annual fishery-related mortality (CV in parentheses) attributable to the pelagic pair trawl fishery was 0.6 dolphins in 1991 (1.0), 4.3 in 1992 (0.76), 3.2 in 1993 (1.0), 0 in 1994 and 3.7 in 1995 (0.45). This fishery ended as of 1996.

In the northeast sink gillnet fishery, Ris~~s~~so's dolphin interactions were observed in 2000, 2005 and 2006. Estimated annual mortalities (CV in parentheses) from this fishery are: 0 in 1999, 15 (1.06) in 2000, 0 in 2001–2004, 15 in 2005 (0.93), and 0 in 2006 through ~~2010~~2011.

Pelagic Longline

Pelagic longline bycatch estimates of Risso's dolphins in 1998, 1999, and 2000 were obtained from Yeung (1999), Yeung *et al.* (2000), and Yeung (2001), respectively. Bycatch estimates for 2001 - ~~2009~~ 2011 were obtained from Garrison (2003), Garrison and Richards (2004), Garrison (2005), Fairfield ~~*et al.*~~Walsh and Garrison (2006, 2007)~~,~~, Fairfield and Garrison (2008), Garrison *et al.* (2009), ~~(~~Garrison and Stokes (2010), and Garrison and Stokes (2012a, 2012b). Most of the estimated marine mammal bycatch was from U.S. Atlantic EEZ waters between South Carolina and Cape Cod. Excluding the Gulf of Mexico, from 1992 to 2000 one mortality was observed in both 1994 and 2000, and 0 in other years. The observed numbers of seriously-injured but released alive individuals from 1992 to ~~2010~~ 2011 were, respectively, 2, 0, 6, 4, 1, 0, 1, 1, 1, 6, 4, 2, 2, 0, 0, 1, 2, 2~~ and~~, 0, and 2. Estimated annual fishery-related mortality (CV in parentheses) was 17 animals in 1994 (1.0), 41 in 2000 (1.0), 24 in 2001(1.0), 20 in 2002 (0.86), and 0 in 2003 to 2008 (Table 2). Seriously injured and released alive animals were estimated to be 54 dolphins (0.7) in 1992, 0 in 1993, 120 (0.57) in 1994, 103 (0.68) in 1995, 99 (1.0) in 1996, 0 in 1997, 57 (1.0) in 1998, 22 (1.0) in 1999, 23 (1.0) in 2000, 45 (0.7) in 2001, 8 (1.0) in 2002, 40 (0.63) in 2003 28(0.72) in 2004, 3(1.0), 0 in 2005, 0 in 2006, 9 (0.65) in 2007, 17 (0.73) in 2008, -11 (0.71) in 2009, ~~and~~ 0 in 2010, and 12 (0.63) in 2011. There is a high likelihood that dolphins released alive with ingested gear or gear wrapped around appendages will not survive (Wells *et al.* 2008). The annual average combined mortality and serious injury for ~~2006~~2007-~~2010~~ 2011 is ~~7.4~~10 ~~(0.36)~~ Risso's dolphins (~~CV =~~0.~~71~~36; Table 2).

Northeast Bottom Trawl

One Risso's dolphin was observed taken in northeast bottom trawl fisheries in 2010 (Table 2). This is the first time this species was observed taken in this fishery. New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al*. in prep). Estimated fishery-related serious injury and mortality values (CV in parentheses) were 3 (0.52) in 2007, 2 (0.56) in 2008, 3 (0.53) in 2009, 2 (0.55) in 2010 and 3 (0.55) in 2011. The 2007–2011 average annual serious injury and mortality attributed to the northeast bottom trawl was 2.5 animals (CV=0.24; Table 2).

Mid-Atlantic Bottom Trawl

Fifteen Risso's dolphins were observed taken in mid-Atlantic bottom trawl fisheries in 2010 (Table 2). This is the first time this species was observed taken in this fishery. New serious injury criteria were applied to all observed

interactions retroactive back to 2007 (Waring *et al*. in prep). The estimated annual fishery-related mortality and serious injury values attributable to the ~~Mid~~mid-Atlantic bottom trawl fishery (CV in parentheses) ~~are~~ were ~~0 in 2006, 0~~ 33 (0.34) in 2007, ~~0~~ 39 (0.69) in 2008, ~~and 0~~ 23 (0.50) in 2009, 54 (0.74) in 2010, and 62 (0.56) in 2011. ~~The 2010 estimate is currently not available. Until this bycatch estimate can be developed, t~~The ~~2006~~2007-~~2010~~ 2011 average annual serious injury and mortality attributed to the mid-Atlantic bottom trawl ~~is calculated as 3 animals (15 animals/5 years)~~was 42 animals (0.29; Table 2).

Mid-Atlantic Gillnet

~~A~~ The only Risso's dolphin mortality ~~was~~ observed ~~in this fishery for the first time in~~was in 2007. The resulting estimated ~~annual~~ serious injury and mortality for 2007 was 34 (CV=0.73). The ~~2006~~2007–~~2010~~ 2011 average annual serious injury and mortality in this fishery is 6.8 Risso's dolphins (~~(CV=~~0.73; Table 2).

Mid-Atlantic Midwater Trawl

A Risso's dolphin mortality was observed in this fishery for the first time in 2008, and not again since. No bycatch estimate has been generated.~~–~~ Until this bycatch estimate can be developed, the ~~2006~~2007–~~2010~~ 2011 average annual serious injury and mortality attributed to the mid-Atlantic midwater trawl is calculated as 0.2 animals (1 animal/5 years).

Table 2. Summary of the incidental mortality of Risso's dolphin (*Grampus griseus*) by commercial fishery including the years sampled ~~(Years)~~, the type of data used ~~(Data Type)~~, the annual observer coverage ~~(Observer Coverage)~~, the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury ~~(Estimated Combined Mortality)~~, the estimated CV of the combined estimates ~~(Estimated CVs)~~ and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Pelagic Longline [c~~b~~]	~~06~~07-~~10~~11	Obs. Data Logbook	~~, .07,~~ .07, .07, .14, .08, .09	~~0,~~ 1, 2, 2, 0, 2	0, 0, 0, 0, 0	~~0,~~ 9, 17, 11, 0, 12	0, 0, 0, 0. 0	~~0,~~ 9, 17, 11, 0, 12	~~0,~~ .65, .73, .71, 0, .63	~~7.~~410 (~~0.71~~0.36)
Mid-Atlantic Gillnet	~~06~~07-~~10~~11	Obs. Data, Trip Logbook, Allocated Dealer Data	~~.04,~~ .04, .03, .03, .04 .02	0, 0, 0, 0, 0	~~0,~~ 1, 0, 0, 0, 0	0, 0, 0, 0, 0	~~0,~~ 34, 0, 0, 0, 0	~~0,~~ 34, 0, 0, 0, 0	~~0,~~ .73, 0, 0, 0, 0	6.8 (0.73)
Northeast Bottom Trawl	07-11	Obs. Data Dealer Data VTR Data	.06, .08, .09, .16, .26	0, 0, 0, 0, 0	0, 0, 0, 1, 0	0, 0, 0, 0, 0	3, 2, 3, 2, 3	3, 2, 3, 2, 3	.52, .56, .53, .55, .55	2.5 (0.24)
Mid-Atlantic Bottom Trawl [d~~e~~]	~~06~~07-~~10~~11	Obs. Data Dealer	~~.02,~~ .03, .03. .05, .06, .08	0, 0, 0, 0 , 0	~~0,~~ 0, 0, 0, 15, 2	0, 0, 0, 0 , 0	~~0, 0, 0, 0, na~~33, 39, 23, 54, 62	33, 39, 23, 54, 62~~0, 0, 0, 0, na~~	~~0, 0, 0, 0, na~~.34, .69, .50, .74, .56	~~3 (na)~~42 (.29)
Mid-Atlantic Midwater Trawl - Including Pair Trawl [d~~e~~]	~~06~~07-~~10~~11	Obs. Data ~~Weighout~~ Trip Logbook	~~.089,~~ .039, .133, .132, .25, .41	0,0,0,0,0	~~0,~~0,1,0, 0, 0	na	na	na	na	0.2 (na)
TOTAL										~~17.~~462 (0.~~42~~22)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (unallocated Dealer Data and Allocated Dealer Data) which are used as a measure of total landings and mandatory Vessel Trip Reports (VTR) (Trip Logbook) are used to determine the spatial distribution of landings and fishing effort. The Observer Program collects landings data (Weighout), and tTotal landings are used as a measure of total effort for the coastal gillnet fishery.

[b] The observer coverages for the Northeast and mid-Atlantic sink gillnet fishery are ratios based on tons of fish landed. Northeast bottom trawl, mid-Atlantic bottom trawl, Northeast mid-water and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for gillnet and bottom trawl gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery at-sea monitors through the Northeast Fisheries Observer Program (NEFOP). For 2010 only the NEFOP observed data were reported in this table, since the at-sea monitoring program just started in May 2010. In the Northeast region 437 and 658 trawl trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 trawl trips were sampled by observers and monitors, respectively.Both at-sea monitor and traditional fisheries observer data were used for 2011.

[c] Estimates can include data pooled across years, so years without observed SI or Mortality may still have an estimated value.

[d] Estimates have not been generated for bottom trawl or midwater trawl. Unexpanded values are provisionally provided.

Other mortality

From 2006 2007 to 2010 2011, 43 Risso's dolphin strandings were recorded along the U.S. Atlantic coast (NMFS unpublished data). Six Seven animals during this time period had indications of human interaction, three of which were fishery interactions. Indications of human interaction are not necessarily the cause of death (Table 3).

In eastern Canada, one Risso's dolphin stranding (unmarked by net entanglement or propeller scarring) was reported on Sable Island, Nova Scotia from 1970 to1998 (Lucas and Hooker 2000).

A Virginia Coastal Small Cetacean Unusual Mortality Event (UME) occurred along the coast of Virginia from 1 May to 31 July 2004, when 66 small cetaceans, including one Risso's dolphin, stranded mostly along the outer (eastern) coast of Virginia's barrier islands.

A Mid-Atlantic Offshore Small Cetacean UME was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Three Risso's dolphins were involved in this UME.

Table 3. Risso's dolphin (*Grampus griseus*) reported strandings along the U.S. Atlantic coast and Puerto Rico, 2007-2011.

STATE	2007	2008	2009	2010	2011	TOTALS
Maine	0	1	0	0	0	1
Massachusetts[a,d]	3	8	4	0	0	15
New York	0	0	0	0	1	1
New Jersey	2	0	1	0	0	3
Delaware	1	0	0	0	0	1
Maryland	0	1	0	1	0	2
Virginia[b]	1	0	2	4	1	8
North Carolina[c]	0	1	3	2	1	7
Georgia	0	0	1	0	0	1
Florida	1	0	0	0	2	3
Puerto Rico	0	0	0	0	1	1
TOTAL	**8**	**11**	**11**	**7**	**6**	**43**

a. One of the 2009 animals had propeller wounds.

b. One of the 2009 animals showed signs of human interaction.

c. One animal in 2006 and 2 in 2009 showed signs of fishery interaction. One animal in 2010 classified as human interaction.

d. 2008 includes 4 animals mass stranded in Massachusetts, 3 of which were released alive.

~~Table 3. Risso's dolphin (*Grampus griseus*) reported strandings along the U.S. Atlantic coast, 2006-2010.~~

~~STATE~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~TOTALS~~
~~Maine~~	~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~
~~Massachusetts[a,d]~~	~~1~~	~~3~~	~~8~~	~~4~~	~~0~~	~~16~~
~~New York~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~New Jersey~~	~~0~~	~~2~~	~~0~~	~~1~~	~~0~~	~~3~~
~~Delaware~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~
~~Maryland~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1~~	~~3~~
~~Virginia[b]~~	~~1~~	~~1~~	~~0~~	~~2~~	~~4~~	~~8~~
~~North Carolina[c]~~	~~1~~	~~0~~	~~1~~	~~3~~	~~2~~	~~7~~
~~Georgia~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~
~~Florida~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~
~~TOTAL~~	~~6~~	~~8~~	~~11~~	~~11~~	~~7~~	~~43~~

~~a. One of the 2009 animals had propeller wounds.~~

~~b. One of the 2009 animals showed signs of human interaction.~~

~~c. One animal in 2006 and 2 in 2009 showed signs of fishery interaction. One animal in 2008 and one in 2010 were classified as human interaction.~~

~~d. 2008 includes 4 animals mass stranded in Massachusetts, 3 of which were released alive.~~

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

STATUS OF STOCK

~~The species is~~Risso's dolphins are not listed as threatened or endangered under the Endangered Species Act and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act.~~;~~ The ~~2006–2010~~ 2007–2011 average annual human-related mortality does not exceed PBR~~; therefore, this is not a strategic stock~~. The total U.S. fishery mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of Risso's dolphins relative to OSP in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated.~~There are insufficient data to determine population trends for this species.~~ ~~The species is not listed as threatened or endangered under the Endangered Species Act.~~

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LONG-FINNED PILOT WHALE (*Globicephala melas melas*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are 2 species of pilot whales in the western Atlantic—the long-finned pilot whale, *Globicephala melas melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea and cannot be reliably visually identified during either abundance surveys or observations of fishery mortality; therefore, the ability to separately assess the 2 ~~stocks~~ species in U.S. Atlantic waters is complex and requires additional information on seasonal spatial distribution~~limited~~. The long-finned pilot whale is distributed from North Carolina to North Africa (and the Mediterranean) and north to Iceland, Greenland and the Barents Sea (Sergeant 1962; Leatherwood *et al.* 1976; Abend 1993; ~~Bucklandd~~Bloch *et al.* 1993; Abend and Smith 1999). The stock structure of the North Atlantic population is uncertain (ICES 1993; Fullard *et al.* 2000). Morphometric (Bloch and Lastein 1993) and genetic (Siemann 1994; Fullard *et al.* 2000) studies have provided little support for stock ~~structure~~ separation across the Atlantic (Fullard *et al.* 2000). However, Fullard *et al.* (2000) have proposed a stock structure that is related to sea-surface temperature: 1) a cold-water population west of the Labrador/North Atlantic current, and 2) a warm-water population that extends across the Atlantic in the Gulf Stream.

In U.S. Atlantic waters, pilot whales (*Globicephala* sp.) are distributed principally along the continental shelf edge off the northeastern U.S. coast in winter and early spring (CETAP 1982; Payne and Heinemann 1993; Abend and Smith 1999; Hamazaki 2002). In late spring, pilot whales move onto Georges Bank and into the Gulf of Maine and more northern waters, and remain in these areas through late autumn (CETAP 1982; Payne and Heinemann 1993). Pilot whales tend to occupy areas of high relief or submerged banks. They are also associated with the Gulf Stream wall and thermal fronts along the continental shelf edge (Waring *et al.* 1992; NMFS unpublished data). Long-finned and short-finned pilot whales overlap spatially along the mid-Atlantic shelf break between ~~Cape Hatteras, North Carolina, and~~ New Jersey and the southern flank of Georges Bank (Payne and Heinemann 1993;~~Garrison *et al.* in prep.).~~ NMFS unpublished data). ~~–~~Long-finned pilot whales have occasionally been observed stranded as far south as South Carolina, and short-finned pilot whales have occasionally been observed stranded as far north as Massachusetts. The

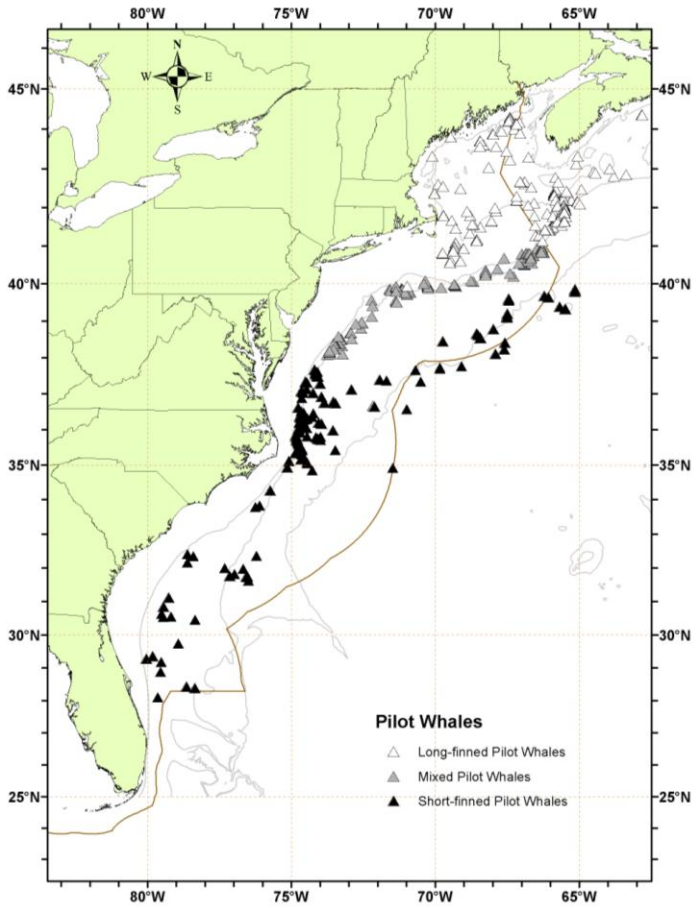

Figure 1. *Distribution of long-finned (open symbols), short-finned (black symbols), and possible mixed (gray symbols; could be either species) pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, ~~and~~ 2007 and 2011. The inferred distribution of the two species is preliminary and is valid for June-August only. Isobaths are ~~at~~ the 100-m, 1,000-m, and 4,000-m depth contours.*

latitudinal ranges of the two species therefore remain uncertain, although south of Cape Hatteras, most pilot whale sightings are expected to be short-finned pilot whales, while north of ~42°N most pilot whale sightings are expected to be long-finned pilot whales (Figure 1).

POPULATION SIZE

The best available estimate for long-finned pilot whales**Error! Bookmark not defined.** in the western North Atlantic is ~~X~~26,535 (CV=~~X.XX~~0.35; Table 1). This estimate is from summer ~~2011~~2006 aerial surveys covering waters from ~~central Florida~~ the southern Gulf of Maine to the upper Bay of Fundy and the Scotian Shelf~~,~~ (Palka 2006). ~~to the lower Bay of Fundy~~The total number of long-finned pilot whales off the eastern U.S. and Canadian Atlantic coast is unknown,~~ although several abundance estimates are available from selected regions for select time periods~~ and this estimate does not include Canadian waters north of the Scotian Shelf or waters along the shelf break south of Georges Bank. ~~-~~Therefore, the current estimate is most likely an underestimate of the stock abundance. Because long-finned and short-finned pilot whales are difficult to distinguish at sea, sighting data are reported as *Globicephala* sp. Sightings from vessel and aerial surveys were strongly concentrated along the continental shelf break south of Georges Bank; however, pilot whales were also observed over the continental slope in waters associated with the Gulf Stream (Figure 1). ~~Combined abundance estimates for the 2 species have previously been derived from line-transect surveys. The best available abundance estimates are from surveys conducted during the summer of 2004. These survey data have been combined with an analysis of the spatial distribution of the 2 species based on genetic analyses of biopsy samples to derive separate abundance estimates (Garrison *et al.*, in prep.). The resulting abundance estimate for long-finned pilot whales in U.S. waters is 12,619 (CV=0.37).~~

Earlier estimates

Please see appendix IV ~~and Table 1~~ for a summary of abundance estimates including earlier estimates and survey descriptions~~ of abundance surveys~~. ~~As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), if estimates are older than 8 years PBR is undetermined. Further, d~~Due to changes in survey methodology, these ~~earlier~~historical data should not be used to make comparisons with more current estimates.

Recent surveys and abundance estimates for *Globicephala* sp.

~~An abundance estimate of 5,408 (CV=0.56) *Globicephala* sp. was obtained from an aerial survey conducted in July and August 2002 that covered 7,465 km of trackline over waters from the 1000-m depth contour on the southern edge of Georges Bank to Maine (Table 1; Palka 2006). The value of *g(0)*, the probability of detecting a group on the track line, used for this estimation was derived from the pooled data of the 2002, 2004 and 2006 aerial surveys.~~

~~An abundance estimate of 15,728 (CV=0.34) *Globicephala* sp. was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5ºN and 38ºN latitude) was conducted during June-August 2004. The survey employed 2 independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and collected a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina, along the shelf break. Data were corrected for visibility bias *g(0)* and group size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for *Globicephala* sp. between Florida and Maryland was 21,056 animals (CV=0.54; Garrison *et al.* in press).~~

An abundance estimate of 26,535 (CV=0.35) *Globicephala* sp. was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; NMFS 2006; NMFS unpublished data~~Palka pers. comm.~~). This survey covered habitats that are expected to exclusively contain long-finned pilot whales.

An abundance estimate of 6,134 (CV=0.28; 95% CI=2,774-10,573) pilot whales was generated from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007. This aerial survey covered the area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. Estimates from this survey have not yet been corrected for availability and perception biases (Lawson and Gosselin 2009). –This survey covered habitats expected to contain long-finned pilot whales exclusively.

— An abundance estimate of 11,865 (CV=0.57) *Globicephala sp.* was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. -Pilot whales were not observed during the aerial portion of the survey. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). -The vessel portion of this survey included habitats where both short-finned and long-finned pilot whales occur. -The estimated abundance of long-finned pilot whales from this survey was 5,636 (CV-=-0.63).

An abundance estimate of 16,946 (CV=0.43) *Globicephala* sp. was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break north of Cape Hatteras, North Carolina, with a lower number of sightings over the continental slope in the southern portion of the survey. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). -This survey included habitats where only short-finned pilot whales are expected to occur.

Spatial Distribution and Abundance Estimates for *Globicephala melas*

Biopsy samples from pilot whales were collected during summer months (June-August) from South Carolina to the southern flank of Georges Bank between 1998 and 2007. These samples were identified to species using genetic analysis of mitochondrial DNA sequences. A portion of the mtDNA genome was sequenced from each biopsy sample collected in the field, and genetic species identification was performed through phylogenetic reconstruction of the haplotypes. Stranded specimens that were morphologically identified to species were used to assign clades in the phylogeny to species and thereby identify all samples. The probability of a sample being from a long-finned (or short-finned) pilot whale was evaluated as a function of sea-surface temperature and water depth using logistic regression. This analysis indicated that the probability of a sample coming from a long-finned pilot whale was near 1 at water temperatures <-22°C, and near 0 at temperatures >25°C. The probability of a long-finned pilot whale also decreased with increasing water depth. Spatially, during summer months, this regression model predicts that all pilot whales observed in offshore waters near the Gulf Stream are most likely short-finned pilot whales. The area of overlap between the 2 species occurs primarily along the shelf break off the coast of New Jersey between 38°N and 40°N latitude. This habitat model was used to partition the abundance estimates from surveys conducted during the summer of 2011. The sightings from the southeast shipboard survey covering waters from Florida to central Virginia were predicted to consist entirely of short-finned pilot whales. The aerial portion of the northeast surveys covered the Gulf of Maine and the Bay of Fundy and surveys where the model predicted that only long-finned pilot whales would occur, but no pilot whales were observed. The vessel portion of the northeast survey recorded a mix of both species along the shelf break, and the sightings in offshore waters near the Gulf Stream were predicted to consist predominantly of short-finned pilot whales. The abundance estimate for long-finned pilot whales from the northeast summer 2011 vessel survey was 5,636 ~~[~~(CV=0.63~~]~~; NMFS unpublished data). The summer 2011 aerial survey of the Gulf of Maine to the Bay of Fundy did not include areas of the Scotian Shelf where the highest densities of pilot whales were observed in the summer of 2006, therefore the 2011 summer surveys are a poor representation of the overall abundance of this stock. –The abundance estimate from the summer 2006 survey is the best available estimate and is expected to exclusively represent long-finned pilot whales based on the results of the logistic regression model. -While this estimate represents animals primarily in Canadian waters during the summer months,

it reflects the abundance of the stock which moves into U.S. waters of the Gulf of Maine during other times of the year and thus interacts with U.S. fisheries. -The best available estimate for the stock is therefore 26,535 (CV-=-0.35). This is an underestimate of the total abundance of long-finned pilot whales in U.S. waters as it does not include estimates from the shelf break south of Georges Bank or waters north of the Scotian Shelf.

~~Table 1. Summary of abundance estimates for the western North Atlantic *Globicephala* sp.long-finned pilot whale by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).~~

~~Month/Year~~	~~Area~~	~~N_{best}~~	~~CV~~
~~Aug 2002~~	~~S. Gulf of Maine to Maine~~	~~5,408~~	~~0.56~~
~~Jun-Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~15,728~~	~~0.34~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~21,056~~	~~0.54~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~36,784~~	~~0.34~~
~~Aug 2006~~	~~S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence~~	~~26,535~~	~~0.35~~
~~July-Aug 2007~~	~~N. Labrador to Scotian Shelf~~	~~6,134~~	~~0.28~~
~~Jun-Aug 2011~~	~~central Virginia to Lower Bay of Fundy~~		
~~Jun-Aug 2011~~	~~central Florida to central Virginia~~		
~~Jun-Aug 2011~~	~~central Florida to lower Bay of Fundy (COMBINED)~~		

Table 1. Summary of abundance estimates for the western North Atlantic long-finned pilot whale by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	26,535	0.35
July-Aug 2007	N. Labrador to Scotian Shelf	6,134	0.28
Jun-Aug 2011	central Virginia to Lower Bay of Fundy	5,636	0.63

~~Spatial Distribution and Abundance Estimates for *Globicephala melas*~~

~~Biopsy samples from pilot whales were collected during summer months (June-August) from South Carolina to the southern flank of Georges Bank between 1998 and 2007. These samples were identified to species using genetic analysis of mitochondrial DNA sequences. A portion of the mtDNA genome was sequenced from each biopsy sample collected in the field, and genetic species identification was performed through phylogenetic reconstruction of the haplotypes. Stranded specimens that were morphologically identified to species were used to assign clades in the phylogeny to species and thereby identify all samples. Based upon the date and location of sample collection, the probability of a sample being from a long-finned (or short-finned) pilot whale was evaluated as a function of sea-surface temperature and water depth using logistic regression. This analysis indicated that the probability of a sample coming from a long-finned pilot whale was near 1 at water temperatures < 22°C, and near 0 at temperatures >25°C. The probability of a long-finned pilot whale also decreased with increasing water depth. Spatially, during summer months, this habitat model predicts that all pilot whales observed in offshore waters near the Gulf Stream are most likely short-finned pilot whales. The area of overlap between the 2 species occurred primarily along the~~

~~shelf break off the coast of New Jersey between 38°N and 40°N latitude. This habitat model was used to partition the abundance estimates from surveys conducted during the summer of 2004. The survey covering waters from Florida to Maryland was predicted to consist entirely of short-finned pilot whales. The aerial portion of the northeast survey covering the Gulf of Maine and the Bay of Fundy and surveys conducted in Canadian waters were predicted to consist entirely of long-finned pilot whales. The vessel portion of the northeast survey contained a mix of both species, with the sightings in offshore waters near the Gulf Stream predicted to consist of short-finned pilot whales. The best abundance estimate for long-finned pilot whales is thus the sum of the northeast aerial survey estimate (11,038 [CV=0.40], Palka 2006) and the estimated number of long-finned pilot whales from the southeast vessel survey (1,581 [CV=0.86]). The best available abundance estimate is thus 12,619 (CV=0.37) (Palka 2006; Garrison *et al.*, in prep; Garrison *et al.*, in press).~~

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for western North Atlantic long-finned pilot whales is ~~12,619~~26,535 -animals (CV=~~0.37~~0.35). ~~This reflects only the portion of the long-finned pilot whale population occupying U.S. waters. This is consistent with guidelines for assessment of trans-boundary stocks since the available mortality estimates are also restricted to U.S. waters.~~ This reflects the abundance of the stock in Canadian waters during summer months; however, the stock moves into U.S. waters during other times of year when it interacts with U.S. fisheries. -The minimum population estimate for long-finned pilot whales is ~~9,333~~19,930.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV->-0.30) remains below 80% (alpha-=-0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).~~There are insufficient data to determine population trends for *Globicephala melas melas*.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. ~~Life history parameters that could be used to estimate net productivity obtained from animals taken in the Newfoundland drive fishery include: calving interval 3.3 years; lactation period about 21-22 months; gestation period 12 months; births mainly from June to November; length at birth of 177 cm; mean length at sexual maturity of 490 cm for males and 356 cm for females; age at sexual maturity of 12 years for males and 6 years for females; mean adult length of 557cm for males and 448 cm for females; and maximum age of 40 for males and 50 for females (Sergeant 1962; Kasuya *et al.* 1988). Analysis of data from animals taken in the Faroe Islands drive fishery produced higher values for all parameters (Bloch *et al.* 1993; Desportes *et al.* 1993; Martin and Rothery 1993). These differences are likely related, at least in part, to larger sample sizes and different analytical techniques.~~

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for long-finned pilot whales is ~~9,333~~ 19,930. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic long-finned pilot whale is ~~93~~199.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual observed average fishery-related mortality or serious injury during 2007-2010 was 44 pilot whales (CV-=-0.15; Table 2). -The total annual human caused mortality of long-finned pilot whales cannot be determined.

The highest bycatch rates of undifferentiated pilot whales in the pelagic longline fishery area were observed during September- October along the mid-Atlantic coast (Garrison 2007). Biopsy samples and photo-identification data collected during October-November, 2011 in this region indicated that all of the animals observed within the region of pelagic longline bycatch during these months were short-finned pilot whales (NMFS unpublished data). During the remainder of the year, pilot whale bycatch in the pelagic longline fishery was likewise restricted to waters where short-finned pilot whales are expected to occur almost exclusively. Therefore, it is likely that the bycatch of pilot whales in the pelagic longline fishery is restricted to short-finned pilot whales. In bottom trawls and mid-water trawls, mortalities are more generally observed north of 40°N latitude and in areas expected to have a higher proportion of long-finned pilot whales. However, analyses to partition mortality estimates from these fisheries between the two species have not been conducted. , most mortalities were observed in the same area between July and November (Rossman 2009). The model used to derive abundance estimates uses data restricted to the warmest months of the year (June-August), and there are currently very few data available for the potential area of overlap during the fall. Therefore, it is not possible to partition mortality estimates between the 2 species because there are very few available genetic samples from the area of overlap and season where most mortality occurs. Mortality and serious injury estimates for bottom and mid-water trawl fisheries are thus presented only for the 2 species combined. Expanded estimates of mortality for 2011 are not available; therefore, estimates from 2007-2010 are presented along with the resulting four-year average. Total annual estimated average fishery-related mortality or serious injury during 2005-2009 was 162 pilot whales (CV=0.15; Table 2). Of this, it is most likely that the mortality due to the pelagic longline fishery, the Northeast midwater trawl fishery, and the Northeast groundfish fishery have the most direct impact on long-finned pilot whales.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the 2 species of pilot whales in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeastern coast of the U.S. A fishery observer program, which has collected fishery data and information on incidental bycatch of marine mammals, was established in 1977 with the implementation of the Fisheries Conservation and Management Act (FCMA).

During 1977-1991, observers in this program recorded 436 pilot whale mortalities in foreign-fishing activities (Waring *et al.* 1990; Waring 1995). A total of 391 pilot whales (90%) was taken in the mackerel fishery, and 41 (9%) occurred during *Loligo* and *Illex* squid-fishing operations. This total includes 48 documented takes by U.S. vessels involved in joint-venture fishing operations. Two animals were also caught in both the hake and tuna longline fisheries (Waring *et al.* 1990).

Between 1989 and 1998, 87 mortalities were observed in the large pelagic drift gillnet fishery. The annual fishery-related mortality (CV in parentheses) was 77 in 1989 (0.24), 132 in 1990 (0.24), 30 in 1991 (0.26), 33 in 1992 (0.16), 31 in 1993 (0.19), 20 in 1994 (0.06), 9.1 in 1995 (0), 11 in 1996 (0.17), no fishery in 1997 and 12 in 1998 (0). This fishery was permanently closed in 1999.

Five pilot whale (*Globicephala* sp.) mortalities were reported in the self-reported fisheries information for the Atlantic tuna pair trawl in 1993. In 1994 and 1995 observers reported 1 and 12 mortalities, respectively. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery in 1994 was 2.0 (CV=0.49) and 22 (CV=0.33) in 1995.

Two interactions with pilot whales in the Atlantic tuna purse seine fishery were observed in 1996. In 1 interaction, the net was pursed around 1 pilot whale, the rings were released and the animal escaped alive, condition unknown. This set occurred east of the Great South Channel and just north of the Cultivator Shoals region on Georges Bank. In a second interaction, 5 pilot whales were encircled in a set. The net was opened prior to pursing to let the whales swim free, apparently uninjured. This set occurred on the Cultivator Shoals region on Georges Bank. No trips were observed during 1997 through 1999. Four trips were observed in September 2001, with no marine mammals observed taken during these trips.

No pilot whales were taken in observed mid-Atlantic coastal gillnet trips during 1993-1997. One pilot whale was observed taken in 1998, and none were observed taken during 1999-2003. Observed effort was scattered between New York and North Carolina from 1 to 50 miles off the beach. All bycatches were documented during January to April. Using the observed takes, the estimated annual mortality attributed to this fishery was 7 (CV=1.10) in 1998.

One pilot whale take was observed in the *Illex* squid portion of the southern New England/mid-Atlantic squid, mackerel, butterfish trawl fisheries in 1996 and 1 in 1998. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was 45 in 1996 (CV=1.27), 0 in 1997, 85 in 1998 (CV=0.65) and 0 in 1999. However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery ~~is~~was included as a component of the mid-Atlantic bottom trawl fishery.

One pilot whale take was observed in the *Loligo* squid portion of the southern New England/mid-Atlantic squid, mackerel, butterfish trawl fisheries in 1999. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was 0 between 1996 and 1998, and 49 in 1999 (CV=0.97). However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery ~~has been~~was included as a component of the mid-Atlantic bottom trawl fishery.

There was 1 observed take in the southern New England/mid-Atlantic bottom trawl fishery reported in 1999. The estimated fishery-related mortality for pilot whales attributable to this fishery was 0 in 1996-1998, and 228 (CV=1.03) in 1999. After 1999 this fishery ~~has been~~was included as a component of the mid-Atlantic bottom trawl fishery.

A U.S. joint venture (JV) mid-water (pelagic) trawl fishery was conducted on Georges Bank from August to December 2001. Eight pilot whales were incidentally captured in a single mid-water trawl during JV fishing operations. Three pilot whales were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF).

For more details on earlier fishery interactions see Waring *et al.* (2007).

Northeast Sink Gillnet

One pilot whale (unidentified to species) was caught in this fishery in 2010. The expanded bycatch estimate was 3 (0.82) in 2010, resulting in a 2007-2011 annual average serious injury and mortality of 1 (0.82).

Pelagic Longline

Most of the estimated marine mammal bycatch in the U.S. pelagic longline fishery was recorded in U.S. Atlantic EEZ waters between South Carolina and Cape Cod (~~Johnson *et al.* 1999; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007; Fairfield and Garrison 2008~~Garrison 2007). Pilot whales are frequently observed to feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). Between 1992 and ~~2008~~2011, ~~154~~ 185 pilot whales were released alive, including ~~83~~ 109 that were considered seriously injured, and ~~5~~ 6 mortalities were observed (Johnson *et al.* 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield~~-~~ Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; Garrison and Stokes 2012a; Garrison and Stokes 2012b). January-March bycatch was concentrated on the continental shelf edge northeast of Cape Hatteras. Bycatch was recorded in this area during April-June, and takes also occurred north of Hydrographer Canyon ~~off the continental shelf~~ in water over 1,000 fathoms (1830 m) deep during April-June. During the July-September period, takes occurred on the continental shelf edge east of Cape Charles, Virginia, and on Block Canyon slope in over 1,000 fathoms of water. October-December bycatch occurred between the 20- and 50-fathom (37- and 92-m) isobaths between Barnegat Bay and Cape Hatteras. ~~-~~Available seasonal biopsy data and genetic analyses indicate that pilot whale bycatch in the pelagic longline fishery is restricted to short-finned pilot whales, therefore the mortality and serious injury due to the pelagic longline fishery is not included in the estimated mortality of the long-finned pilot whale.

~~The estimated fishery related mortality to pilot whales in the U.S. Atlantic (excluding the Gulf of Mexico) attributable to this fishery was: 127 in 1992 (CV=1.00), 0 from 1993-1998, 93 in 1999 (CV=1.00), 24 in 2000 (CV=1.00), 20 (CV=1.00) in 2001, 2 (CV=1.00) in 2002, 0 in 2003-2005, 16 (CV=1.00) in 2006 and 0 in 2007. The estimated serious injuries were 40 (CV=0.71) in 1992, 19 (CV=1.00) in 1993, 232 (CV=0.53) in 1994, 345 (CV=0.51) in 1995 including 37 estimated short-finned pilot whales (CV=1.00), 0 from 1996 to 1998, 288 (CV=0.74) in 1999, 109 (CV=1.00) in 2000, 50 in 2001 (CV=0.58), 51 in 2002 (CV=0.48), 21 in 2003 (CV=0.78), 74 in 2004 (CV=0.42), 212 (CV=0.21) in 2005, 169 (CV=0.47) in 2006, 57 (CV=0.47) in 2007, 98 (CV=0.42) in 2008 and 17 (CV=0.70) in 2009. The average 'combined' annual mortality in 2005-2009 was 114 pilot whales (CV=0.20) (Table 2).~~

~~An experimental fishery was conducted on 6 vessels operating in the Gulf of Mexico and off the U.S. East Coast in 2005, with 100% observer coverage achieved. During this experiment, different hook baiting techniques with standardized gangion and float line lengths were used, and hook timers and time-depth recorders were attached to the gear. The fishing techniques and gear employed during this experimental fishery do not represent those used during "normal" fishing efforts, and are thus presented separately in Table 2. Three pilot whales were released alive during this experimental fishery, including 1 that was seriously injured (Fairfield Walsh and Garrison 2006).~~

Mid-Atlantic Bottom Trawl

~~Two pilot whales were observed taken in the mid-Atlantic bottom trawl in 2000, 4 in 2005, 1 in 2006, 0 in 2007, 0 in 2008, and 0 in 2009.~~ Seven pilot whales were observed taken in the mid-Atlantic bottom trawl fishery during 2000-2006. No pilot whales were observed taken during 2007-2011. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was: 47 (CV=0.32) in 2000, 39 (CV=0.31) in 2001, 38 (CV=0.36) in 2002, 31 (CV=0.31) in 2003, 35 (CV=0.33) in 2004, 31 (CV=0.31) in 2005, 37 (CV=0.34) in 2006, 36 (CV=0.38) in 2007, 24 (CV=0.36) in 2008, ~~and~~ 23 (CV=0.35) in 2009, and 22 (CV~~=~~=0.35) in 2010. Expanded estimates of fishery mortality for 2011 are not available, and mortalities have not been assigned to species. The ~~2005-2009~~ 2007-2010 average mortality attributed to the mid-Atlantic bottom trawl was ~~30~~ 29 animals (CV=~~0.16~~0.19) (Table 2).

Northeast Bottom Trawl

~~Two pilot whales were observed taken in the Northeast bottom trawl in 2004, 4 in 2005, 1 in 2006, 4 in 2007, 5 in 2008, and 3 in 2009. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was: 18 (CV=0.29) in 2000, 30 (CV=0.27) in 2001, 22 (CV=0.26) in 2002, 20 (CV=0.26) in 2003, 15 (CV=0.29) in 2004, 15 (CV=0.30) in 2005, 14 (CV=0.28) in 2006, 12 (CV=0.35) in 2007,10 (CV=0.34) in 2008, and 9 (CV=0.35) in 2009. The 2005-2009 average mortality attributed to the northeast bottom trawl was 12 animals (CV=0.14) (Table 2).~~ Seven pilot whales were observed taken in the Northeast bottom trawl fishery during 2004-2006. New serious injury criteria were applied to all observed interactions retroactive to 2007 (Waring *et al*. in prep). Observed serious injuries and mortalities of pilot whales included 4 in 2007, 5 in 2008, 3 in 2009, 10 in 2010, and 12 in 2011. In addition to takes observed by fisheries observers, the Marine Mammal Authorization Program (MMAP) included 2 self-reported incidental takes (mortalities) of pilot whales in bottom trawl gear off Maine and Massachusetts during 2008, and 2 self-reported incidental takes (mortalities) in trawl gear off Maine and Rhode Island during 2011. These reports do not contribute to the estimate of mortality from the observer program. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was: 18 (CV=0.29) in 2000, 30 (CV=0.27) in 2001, 22 (CV=0.26) in 2002, 20 (CV=0.26) in 2003, 15 (CV=0.29) in 2004, 15 (CV=0.30) in 2005, 14 (CV=0.28) in 2006, 12 (CV=0.35) in 2007, 10 (CV=0.34) in 2008, 9 (CV=0.35) in 2009, and 9 (CV~~=~~=0.35) in 2010. Expanded estimates of fishery mortality for 2011 are not available, and mortalities have not been assigned to species. The 2007–2010 average mortality attributed to the Northeast bottom trawl was 10 animals (CV=0.18~~) (~~; Table 2).

Northeast Mid-Water Trawl (Including Pair Trawl)

In September 2004 a pilot whale was observed taken in the paired mid-water trawl fishery on the northern edge of Georges Bank (off Massachusetts) in a haul that was targeting (and primarily caught) herring. In April 2008, six pilot whale takes were observed in the single mid-water trawl fishery in hauls targeting mackerel and located on the southern edge of Georges Bank. In September 2011, one pilot whale was taken in the mid-water trawl fishery on the

northern flank of Georges Bank Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed takes per observed hours the gear was in the water) for each year, where the paired and single Northeast mid-water trawls were pooled and only hauls that targeted herring or mackerel were used. The VTR herring and mackerel data were used to estimate the total effort (~~Palka, pers. comm.~~NMFS unpublished data). Estimated annual fishery-related mortalities were: unknown in 2001-2002, 0 in 2003, 5.6 (CV=0.92) in 2004, 0 in 2005 to 2007, 16 (CV=0.61) in 2008 and 0 in 2009 to 2010 (Table 2~~; Palka pers. comm.~~). -Expanded estimates of fishery mortality for 2011 are not available, and mortalities have not been assigned to species. –The average annual estimated mortality during ~~2005-2009~~2007-2010 was ~~3~~ 4 (CV=0.61~~) (~~; Table 2).

Mid-Atlantic Mid-Water Trawl Fishery (Including Pair Trawl)

In March 2007 a pilot whale was observed bycaught in the single mid-water fishery south of Rhode Island in a haul targeting herring~~ that was south of Rhode Island~~. Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed pilot whale takes per observed hours the gear was in the water) for each year, where the paired and single Mid-Atlantic mid-water trawls were pooled and only hauls that targeted herring or mackerel were used. The VTR herring and mackerel data were used to estimate the total effort (~~Palka, pers. comm.~~NMFS unpublished data). Estimated annual fishery-related mortalities were unknown in 2002, 0 in 2003 to 2006, 12.1 (CV=0.99) in 2007, and 0 in 2008 to 2011 ~~and 0 in 2009~~ (Table 2). ~~; Palka pers. comm.).~~ The average annual estimated mortality during ~~2005-2009~~2007-2011 was 2.4 (CV=0.99;~~).~~ (Table 2). -Mortalities have not been assigned to species.

CANADA

Unknown numbers of long-finned pilot whales have also been taken in Newfoundland, Labrador, and Bay of Fundy groundfish gillnets; Atlantic Canada and Greenland salmon gillnets; and Atlantic Canada cod traps (Read 1994).

Between January 1993 and December 1994, 36 Spanish deep-water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Banks) (Lens 1997). A total of 47 incidental catches was recorded, which included 1 long-finned pilot whale. The incidental mortality rate for pilot whales was 0.007/set.

In Canada, the fisheries observer program places observers on all foreign fishing vessels, on between 25% and 40% of large Canadian vessels (greater than 100 ft), and on approximately 5% of small vessels (Hooker *et al.* 1997). Fishery observer effort off the coast of Nova Scotia during 1991-1996 varied on a seasonal and annual basis, reflecting changes in fishing effort (see Figure 3, Hooker *et al.* 1997). During the 1991-1996 period, long-finned pilot whales were bycaught (number of animals in parentheses) in bottom trawl (65); midwater trawl (6); and longline (1) gear. Recorded bycatches by year were: 16 in 1991, 21 in 1992, 14 in 1993, 3 in 1994, 9 in 1995 and 6 in 1996. Pilot whale bycatches occurred in all months except January-March and September (Hooker *et al.* 1997).

There was 1 record of incidental catch in the offshore Greenland halibut fishery that involved 1 long-finned pilot whale in 2001; no expanded bycatch estimate was calculated (Benjamins *et al.* 2007).

~~Table 2. Summary of the incidental mortality and serious injury of pilot whales (*Globicephala* sp.) by commercial fishery including the years sampled (Years), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).~~

~~Fishery~~	~~Years~~	~~Data Type~~ [a]	~~Observer Coverage~~ [b]	~~Observed Serious Injury~~	~~Observed Mortality~~	~~Estimated Serious Injury~~	~~Estimated Mortality~~	~~Estimated Combined Mortality~~	~~Estimated CVs~~	~~Mean Annual Mortality~~

~~Mid-Atlantic Bottom Trawl[e]~~	~~05-09~~	~~Obs. Data Dealer~~	~~.03, .02, .03, .03, .05~~	~~0, 0, 0, 0, 0~~	~~4, 1, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~31, 37, 36, 24, 23~~	~~31, 37, 36, 24, 23~~	~~.31, .34, .38, .36, .36~~	~~30 (.16)~~
~~Northeast Bottom Trawl[e]~~	~~05-09~~	~~Obs. Data Dealer Data VTR Data~~	~~.12, .06, .06, .08, .05~~	~~0, 0, 0, 0, 0~~	~~4, 1, 4, 5, 3~~	~~0, 0, 0, 0, 0~~	~~15, 14, 12, 10, 9~~	~~15, 14, 12, 10, 9~~	~~.30, .28, .35, .34, .35~~	~~12 (.14)~~
~~Mid-Altlantic Mid-Water Trawl - Including Pair Trawl[d]~~	~~05-09~~	~~Obs. Data Dealer Data VTR Data~~	~~.08, .09, .04, .13, .13~~	~~0, 0, 0, 0, 0~~	~~0, 0, 1, 0, 0~~	~~0, 0, 0, 0, 0~~	~~0, 0, 12, 0, 0~~	~~0, 0, 12, 0, 0~~	~~0, 0, 0.99, 0, 0~~	~~2.4 (.99)~~
~~Northeast Mid-Water Trawl - Including Pair Trawl[d]~~	~~05-09~~	~~Obs. Data Dealer Data VTR Data~~	~~.20, .03, .08, .20, .42~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 6, 0~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 16, 0~~	~~0, 0, 0, 16, 0~~	~~0, 0, 0, .61, 0~~	~~3 (.61)~~
~~Pelagic Longline~~	~~05-09~~	~~Obs. Data Logbook~~	~~.06, .07, .07, .07, .10~~	~~9, 12, 5, 5, 2~~	~~0, 1, 0, 0, 0~~	~~212, 169, 57, 98, 17~~	~~0, 16, 0, 0, 0~~	~~212, 185, 57, 98, 17~~	~~.21, .47, .65, .42, .70~~	~~114 (.20)~~
~~2005 Pelagic Longline experimental fishery[e]~~	~~05~~	~~Obs. Data~~	~~1~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1(0)~~
~~TOTAL~~										~~162 (.15)~~

~~[a] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).~~

~~[b] Observer coverage of the mid Atlantic coastal gillnet fishery is a ratio based on tons of fish landed. Observer coverage for the longline fishery is a ratio based on sets. The trawl fisheries are ratios based on trips.~~

~~[c] NE and MA bottom trawl mortality estimates reported for 2007 to 2009 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2007 to 2009 effort. Complete documentation of methods used to estimate cetacean bycatch mortality are described in Rossman (2010).~~

~~[d] Within each of the fisheries (Northeast and Mid Atlantic), the paired and single trawl data were pooled. Ratio estimation methods were used within each fishery and year to estimate the total the annual bycatch.~~

~~[e] A cooperative research program conducted during quarters 2 and 3 in 2005 (Fairfield Walsh and Garrison 2006).~~

Table 2. Summary of the incidental mortality and serious injury of pilot whales (*Globicephala sp.*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Est. CVs) and the mean of the combined estimates (CV in parentheses). These are minimum observed counts as expanded estimates are not available.

Fishery	Years	Data Type[a]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality

Northeast Sink Gillnet	07-11	Obs. Data, Logbook, Dealer Data	.07, .05, .04, .17, .19	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, 3	0, 0, 0, 0, 3	0, 0, 0, 0, .82	1 (.82)
Northeast Bottom Trawl [b]	07-11	Obs. Data Logbook	.06, .08, .09, .16, .26	1,0,2,0,3	3,5,1,6,9	na	na	12,10,9,9, na	.35,.34,.34, .35, na	10 (.18)
Mid-Atlantic Bottom Trawl [b]	07-11	Obs. Data Logbook	.03, .03, .05, .06, .08	0,0,0,0,0	0,0,0,0,0	0,0,0,0,0	36,24,23, 22, na	36,24,23,22, na	.38,.36,.36,.35,na	26 (.19)
Northeast Mid-Water Trawl - Including Pair Trawl [c]	07-11	Obs. Data Dealer Data VTR Data	.08, .20, .42, .41, .17	0,0,0,0,0	0,6,0,0,1	0,0,0,0,0	0,16,0,0, na	0,16,0,0, na	0,.61,0,0, na	4 (.61)
Mid-Altlantic Mid-Water Trawl - Including Pair Trawl[c]	07-11	Obs. Data Dealer Data VTR Data	.04, .13, .13, .25, .41	0,0,0,0,0	1,0,0,0,0	0,0,0,0,0	12,0,0,0,0	12,0,0,0,0	0.99,0,0,0, 0	2.4 (0.99)
TOTAL										44 (0.15)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program (NEFOP) and the Southeast Pelagic Longline Observer Program. The NEFOP collects landings data (Weighout), and total landings are used as a measure of total effort for the coastal gillnet fishery. Total observer coverage reported for gillnet and bottom trawl gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery at-sea monitors. For 2010 only the NEFOP observed data were reported in this table, since the at-sea monitoring program just started in May 2010.

[b] Estimates have not been generated for bottom trawl or midwater trawl fisheries for 2011. Average annual mortality represents the four year average (2007-2010) for these fisheries. MA and NE bottom trawl fishery mortality estimates presented for 2007-2010 are a product of bycatch rates estimated from a GLM using observer data from 2000 to 2005 and reported effort from 2007-2010. Documentation of methods used to estimate cetacean bycatch mortality is available in Rossman (2010).

[c] Within each of the fisheries (Northeast and Mid-Atlantic), the paired and single trawl data were pooled. Ratio estimation methods were used within each fishery and year to estimate the total the annual bycatch. Expanded estimates for 2011 are not available for these fisheries.

Other Mortality

Pilot whales have a propensity to mass strand throughout their range, but the role of human activity in these events is unknown. Between 2 and 168 pilot whales have stranded annually, either individually or in groups, along the eastern U.S. seaboard since 1980 (NMFS 1993, stranding databases maintained by NMFS NER, NEFSC and SEFSC). From ~~2004~~2007 to ~~2008~~2011, ~~44~~21 short-finned pilot whales (*Globicephala macrorhynchus*), ~~68~~41 long-finned pilot whales (*Globicephala melas melas*), and ~~11~~6 pilot whales not specified to the species level (*Globicephala* sp.) were reported stranded between Maine and Florida, including ~~Puerto Rico and~~ the Exclusive Economic Zone (EEZ) (Table 3). ~~This includes 1 mass stranding of 18 long finned pilot whales (including 1 pregnant female) as part of a multi-species mass stranding in Barnstable County, Massachusetts, on 10 December 2005 (Fehring and Wells 1976; Irvine *et al.* 1979; Odell *et al.* 1980).~~

~~A Virginia Coastal Small Cetacean Unusual Mortality Event (UME) occurred along the coast of Virginia from 1 May to 31 July 2004, when 66 small cetaceans stranded mostly along the outer (eastern) coast of Virginia's barrier islands, including 1 pilot whale (*Globicephala* sp.). Human interactions were implicated in 17 of the strandings (1 common and 16 bottlenose dolphins), other potential causes were implicated in 14 strandings (1 Atlantic white-sided~~

~~dolphin, 2 harbor porpoises and 11 bottlenose dolphins), and no cause could be determined for the remaining strandings, including the pilot whale.~~

~~An Offshore Small Cetacean UME, was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. One short-finned pilot whale was involved in this UME.~~

~~A UME mass stranding of 33 short-finned pilot whales, including 5 pregnant females, near Cape Hatteras, North Carolina, occurred from 15-16 January 2005. Gross necropsies were conducted and samples were collected for pathological analyses (Hohn *et al.* 2006), but no single cause for the UME was determined.~~

Short-finned pilot whales strandings have been reported stranded as far north as Nova Scotia (1990) and Block Island, Rhode Island (2001), and Cape Cod, Massachusetts (2011), ~~-~~though the majority of the strandings occurred from North Carolina southward (Table 3). Long-finned pilot whales have been reported stranded as far south as Florida, where 2 long-finned pilot whales were reported stranded in Florida in November 1998, though their flukes had been apparently cut off, so it is unclear where these animals actually may have died. One additional long-finned pilot whale stranded in South Carolina in 2003, though the confidence in the species identification was only moderate. A genetic sample~~s~~ from ~~T~~this animal has subsequently been sequenced and mitochondrial DNA analysis supports the long-finned pilot whale identification. ~~Most of the remaining~~Recent long-finned pilot whale strandings were from ~~North Carolina~~New Jersey northward (Table 3).

During ~~2005-2009~~2007-2011, several human and/or fishery interactions were documented in stranded pilot whales. ~~During a UME in Dare, North Carolina, in January 2005, 6 of the 33 short-finned pilot whales which mass stranded had fishery interaction marks (specifics not given) that were healed and determined not to be the cause of death. A short-finned pilot whale stranded in May 2005 in North Carolina had net marks around the leading edge of the dorsal fin from the top to bottom, and had net marks on both fluke lobes. Two long-finned pilot whales stranded in Virginia in April 2005, 1 with a line on its flukes and another with human interactions noted but specifics not given. Of the 2006 stranding mortalities, 2 were reported as exhibiting signs of human interaction, 1 in Massachusetts and 1 in Virginia.~~ In 2008, 1 Massachusetts stranding mortality was deemed a fishery interaction due to line markings and cut flukes. ~~The~~Also in 2008, 2 of the New York strandings of long-finned pilot whales were classified as human interactions. One long-finned pilot whale that stranded in Massachusetts in 2009 was classified as a fishery~~human~~ interaction because it had a piece of monofilament line in its stomach.

~~Table 3. Pilot whale (*Globicephala macrorhynchus* [SF], *Globicephala melas melas* [LF] *and Globicephala* sp. [Sp]) strandings along the Atlantic coast, 2005-2009. Strandings that were not reported to species have been reported as *Globicephala* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded pilot whales to species, reports to specific species should be viewed with caution.~~

~~STATE~~	~~2005~~			~~2006~~			~~2007~~			~~2008~~			~~2009~~			~~TOTALS~~		
	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~
~~Nova Scotia[a]~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~15~~	~~0~~	~~0~~	~~22~~
~~Newfoundland and Labrador[b]~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~2~~	~~7~~
~~Maine[c]~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~3~~	~~0~~	~~0~~	~~8~~	~~1~~
~~New Hampshire~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~
~~Massachusetts[d]~~	~~0~~	~~22~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~6~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~4~~	~~0~~	~~0~~	~~35~~	~~1~~
~~Rhode Island~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~4~~	~~0~~
~~New York~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~6~~	~~0~~
~~New Jersey~~	~~0~~	~~0~~	~~2~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~	~~1~~	~~0~~	~~2~~	~~3~~	~~2~~
~~Delaware~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~
~~Maryland~~	~~0~~	~~4~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~
~~Virginia[e]~~	~~0~~	~~4~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~6~~	~~0~~
~~North Carolina[f]~~	~~35~~	~~1~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~1~~	~~2~~	~~0~~	~~0~~	~~40~~	~~1~~	~~4~~

South Carolina	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
Florida	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEZ	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
TOTALS - U.S., Puerto Rico, & EEZ	35	35	4	1	6	1	0	10	0	3	7	4	4	11	0	43	69	9

[a] Data supplied by Tonya Wimmer, Nova Scotia Marine Animal Response Society (pers. comm.).
[b] (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010).
[c] Long-finned pilot whale stranded in Maine in 2007 released alive.
[d] Includes 18 pilot whales which were part of a multi-species mass stranding in Brewster on 10 December 2005. One of the strandings in 2007 classified as human interaction due to attempts to herd the animal to deeper water. One of the 2009 animals was classified as a fishery interaction.
[e] One pilot whale stranded in Virginia in 2004 during an Unusual Mortality Event but was not identified to species (decomposed and decapitated). Sign of human interaction (a line on the flukes) observed on 2 animals in 2005, and 1 animal was a pregnant female.
[f] In 2004, 1 short-finned pilot whale (September) and 1 pilot whale (November) not identified to species stranded in North Carolina during an Unusual Mortality Event (UME). A long-finned pilot whale also stranded in February, not related to any UME. 2005 includes Unusual Mortality Event mass stranding of 33 short-finned pilot whales on 15-16 January, 2005, including 5 pregnant females. Six animals had fishery interaction marks, which were healed and not the cause of death. Signs of fishery interaction observed on a short-finned pilot whale stranded in May 2005.

Table 3. Pilot whale (*Globicephala macrorhynchus* [SF], *Globicephala melas melas* [LF] *and Globicephala* sp. [Sp]) strandings along the Atlantic coast, 2007-2011. Strandings that were not reported to species have been reported as *Globicephala* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded pilot whales to species, reports to specific species should be viewed with caution.

STATE	2007			2008			2009			2010			2011			TOTALS		
	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp
Nova Scotia[a]	0	0	2	0	0	0	0	0	15	0	0	11	0	0	19	0	0	47
Newfoundland and Labrador[b]	0	0	1	0	0	2	0	0	1	0	0	1	0	0	8	0	0	13
Maine[c]	0	1	0	0	1	0	0	3	0	0	0	0	0	1	0	0	6	0
Massachusetts[d]	0	6	0	0	1	0	0	4	0	0	2	0	3	4	0	3	17	0
Rhode Island	0	0	0	0	2	0	0	2	0	0	0	0	0	2	0	0	6	0
New York[e]	0	2	0	0	5	0	0	1	0	0	0	0	0	1	0	0	9	0
New Jersey	0	1	0	0	1	0	1	1	0	0	0	0	1	0	1	2	3	1
Delaware	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Virginia	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
North Carolina[f]	0	0	0	3	0	1	2	0	0	1	0	0	1	0	0	7	0	1
South Carolina	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2
Florida[g]	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0	6	0	0
TOTALS - U.S. & EEZ	0	10	0	3	10	2	4	11	0	5	2	3	7	8	1	19	41	6

[a] Data supplied by Nova Scotia Marine Animal Response Society (pers. comm.). Strandings in 2011 include one mass stranding of 6-8 whales (one of which died) and 2 animals with ropes tied around their tail stocks.
[b] (Ledwell and Huntington 2006; 2007; 2008; 2009; 2010; 2012; Ledwell *et al.* 2011). 2011 included 2 mom/calf

pairs. Not included in 2011 total was group of 6 pilot whales shepherded out a narrow channel.
[c] Long-finned pilot whale stranded in Maine in 2007 released alive.
[d] One of the strandings in 2007 classified as human interaction due to attempts to herd the animal to deeper water. One of the 2008 animals classified as a fishery interaction due to line markings and cut flukes. One of the 2009 animals was classified as a fishery interaction. One of the 2010 animals released alive. One of the strandings in 2011 was classified as a human interaction due to attempts by public to push the animal back into the water.
[e] Two of the 2008 strandings were classified as human interactions.
[f] Signs of fishery interaction observed on a short-finned pilot whale stranded in Feb 2010.
[g] One of the 2010 animals released alive.

In eastern Canada, 37 strandings of long-finned pilot whales (173 individuals) were reported on Sable Island, Nova Scotia, from 1970 to 1998 (Lucas and Hooker 2000). This included 130 animals that mass stranded in December 1976, and 2 smaller groups (<10 each) in autumn 1979 and summer 1992. Fourteen strandings were also recorded along Nova Scotia in 1991-1996 (Hooker *et al.* 1997). Several live mass-strandings occurred in Nova Scotia ~~recently~~, including 14 in 2000, 3 in 2001 in Judique, Inverness County, and 4 ~~pilot whales live mass stranded~~ at Point Tupper, Inverness County, in 2002, though no specification to species was made.

Mass strandings of long-finned pilot whales were more frequent several decades ago in Newfoundland ~~when this species was more abundant~~ (Table 4). Recent Newfoundland and Labrador strandings are reported in Table 3.

Table 4. Pilot whale mass strandings along the Newfoundland, Canada coast.

Year	Date	Number of Pilot Whales Stranded	Place in Newfoundland
1979	July 14	135	Pt. au Gaul
1980	October 19 October 25	70 18	Pt. Leamington Grand Beach
1982	July 27 August 18	23 3	Grand Bank Bonavista
1983	early January	10	Piccadilly
1984	July 15	5	Middle Cove
1990	December 14	4	St. Anthony

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

A potential human-caused source of mortality is from polychlorinated biphenyls (PCBs) and chlorinated pesticides (DDT, DDE, dieldrin, etc.), moderate levels of which have been found in pilot whale blubber (Taruski *et al.* 1975; Muir *et al.* 1988; Weisbrod *et al.* 2000). Weisbrod *et al.* (2000) reported that bioaccumulation levels were more similar in whales from the same stranding group than animals of the same sex or age. Also, high levels of toxic metals (mercury, lead, cadmium) and selenium were measured in pilot whales harvested in the Faroe Island drive fishery (Nielsen *et al.* 2000). Similarly, Dam and Bloch (2000) found very high PCB levels in pilot whales in the Faroes. The population effect of the observed levels of such contaminants is unknown.

STATUS OF STOCK

~~The status of long-finned pilot whales relative to OSP in U.S. Atlantic EEZ is unknown. There are insufficient data to determine population trends for this species.~~ The ~~western North Atlantic~~ long-finned pilot whale ~~species~~ is not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The total U.S. fishery-related mortality and serious injury for long-finned pilot whales is unknown, since it is not possible to partition mortality estimates between the long-finned and short-finned pilot whales and mortality estimates for the bottom and midwater trawl fisheries in 2011 are not available. However, it is most likely not less than 10% of the calculated PBR and therefore cannot be

considered to be insignificant and approaching zero mortality and serious injury rate. It is unlikely that total human caused mortality exceeds PBR~~; The total fishery mortality may exceed PBR; however, it is unknown to what extent the pelagic longline fishery in particular impacts this stock. Due to the possibility of exceeding PBR, this should be considered therefore, this is not a strategic stock~~. However, the inability to partition mortality estimates in the midwater and bottom trawl fisheries between the species limits the ability to adequately assess the status of this stock. ~~-~~The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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SHORT-FINNED PILOT WHALE (*Globicephala macrorhynchus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are 2 species of pilot whales in the western North Atlantic - the long-finned pilot whale, *Globicephala melas melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea and cannot be reliably visually identified during either abundance surveys or observations of fishery mortality; therefore, the ability to separately assess the 2 ~~stocks~~ species in U.S. Atlantic waters is ~~limited~~complex and requires additional information on seasonal spatial distribution. ~~. Sightings of~~ Undifferentiated pilot whales (*Globicephala* sp.) in the western North Atlantic occur primarily near the continental shelf break ranging from Florida to the Nova Scotia~~n~~ Shelf (Mullin and Fulling 2003). Long-finned and short-finned pilot whales overlap spatially along the mid-Atlantic shelf break between ~~Cape Hatteras, North Carolina, and~~ New Jersey and the southern flank of Georges Bank (Payne and Heinemann 1993; ~~Garrison *et al.*, in prep~~NMFS unpublished data~~.~~). ~~–~~Long-finned pilot whales have occasionally been observed stranded as far south as South Carolina, and short-finned pilot whales have occasionally been observed stranded as far north as Massachusetts. ~~–~~The latitudinal ranges of the two species therefore remain uncertain, although south of Cape Hatteras, most pilot whale sightings are expected to be short-finned pilot whales, while north of ~42°N most pilot whale sightings are expected to be long-finned pilot whales (Figure 1). In addition, short-finned pilot whales are documented along the continental shelf and continental slope in the northern Gulf of Mexico (Hansen *et al.* 1996; Mullin and Hoggard 2000; Mullin and Fulling 2003), and they are also known from the wider Caribbean. Studies are currently being conducted at the Southeast Fisheries Science Center to evaluate genetic population structure in short-finned pilot whales. Pending these results, the *Globicephala macrorhynchus* population occupying U.S. Atlantic waters is considered separate from both the northern Gulf of Mexico stock and short-finned pilot whales occupying Caribbean waters.

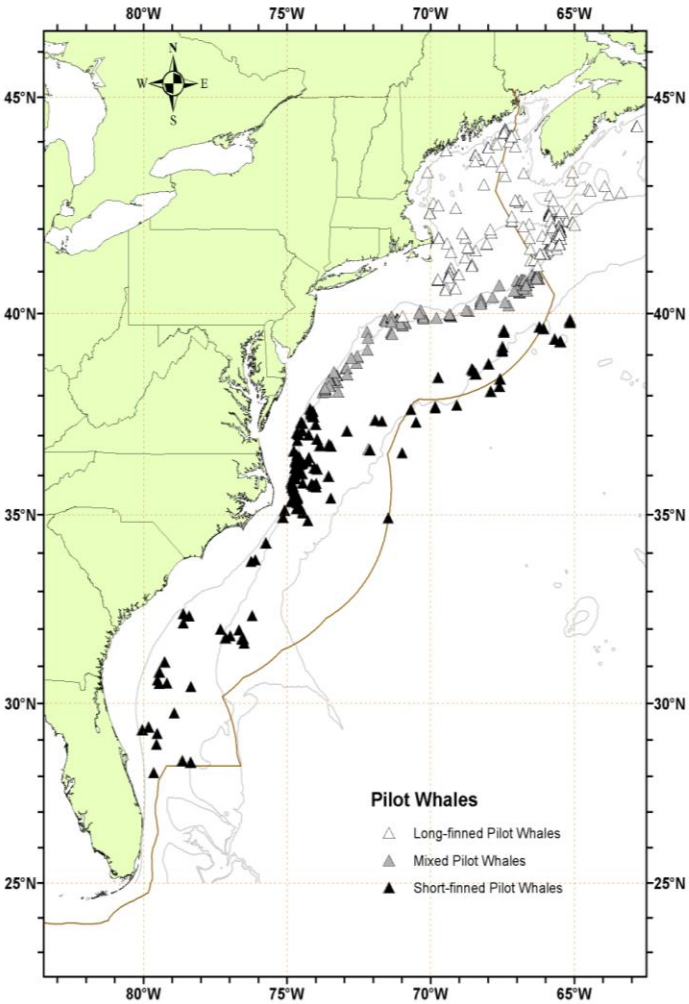

Figure 1. *Distribution of long-finned (open symbols), short-finned (black symbols), and possibly mixed (gray symbols; could be either species) pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, ~~and~~ 2007 and 2011. The inferred distribution of the two species is preliminary and is valid for June-August only. Isobaths are ~~at~~ the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

The best available estimate for short-finned pilot whales**Error! Bookmark not**

defined. in the western North Atlantic is ~~X~~21,515 (CV=~~X.XX~~0.37; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. ~~The total number of short-finned pilot whales off the eastern U.S. Atlantic coast is unknown, although several abundance estimates are available from selected regions for select time periods.~~ Because long-finned and short-finned pilot whales are difficult to distinguish at sea, sightings data are reported as *Globicephala sp.* Sightings from vessel and aerial surveys were strongly concentrated along the continental shelf break; however, pilot whales were also observed over the continental slope in waters associated with the Gulf Stream (Figure 1). Combined abundance estimates for the 2 species have previously been derived from line transect surveys. The best available abundance estimates are from aerial and shipboard surveys conducted during the summer of ~~2004~~ 2011 because these are the most recent surveys covering the full range of pilot whales in U.S. Atlantic waters. These survey data have been combined with an analysis of the spatial distribution of the 2 species based on genetic analyses of biopsy samples to derive separate abundance estimates (~~Garrison *et al.*, in prep~~NMFS~~,~~ unpub~~.~~lished data). ~~The resulting abundance estimate for short-finned pilot whales is 24,674 (CV=0.45).~~

Earlier Estimates

Please see appendix IV for a summary of abundance estimates including earlier estimates and survey descriptions. Due to changes in survey methodology, these historical data should not be used to make comparisons with more current estimates.~~Please see appendix IV for earlier estimates and descriptions of abundance surveys. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), if estimates are older than 8 years PBR is undetermined. Further, due to changes in survey methodology, the earlier data should not be used to make comparisons with more current estimates.~~

Recent surveys and abundance estimates for *Globicephala* sp.

~~An abundance estimate of 5,408 (CV=0.56) *Globicephala* sp. was obtained from an aerial survey conducted in July and August 2002 covering 7,465 km of trackline in U.S. waters from the 1,000 m depth contour on the southern edge of Georges Bank north to the Gulf of Maine (Table 1; Palka 2006). The value of *g(0)*, the probability of detecting a group on the track line, used for this estimation was derived from the pooled data of the 2002, 2004 and 2006 aerial surveys.~~

~~An abundance estimate of 15,728 (CV=0.34) *Globicephala* sp. was obtained from a line transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the 2 independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*. Aerial data were collected using the Hiby circle back line transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5°N and 38ºN latitude) was conducted during June-August 2004. The survey employed 2 independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and collected a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina, along the shelf break. Data were corrected for visibility bias *g(0)* and group size bias and analyzed using line transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for *Globicephala* sp. between Florida and Maryland was 21,056 animals (CV=0.54; Garrison *et al.*, in press).~~

An abundance estimate of 26,535 (CV=0.35) *Globicephala* sp. was obtained from an aerial survey conducted in August 2006 that covered 10,676 km of trackline in the region from the 2,000-m depth contour on the southern edge of Georges Bank north to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; ~~NMFS 2006Palka pers. comm~~NMFS unpublished data~~.~~). This survey covered habitats that are expected to exclusively contain long-finned pilot whales.

An abundance estimate of 6,134 (95% CI=2,774-10,573) pilot whales was generated from the Canadian Trans North Atlantic Sighting Survey (TNASS) in July-August 2007. This aerial survey covered the area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. Estimates from this survey have not yet been corrected for availability and perception biases (Lawson and Gosselin 2009). This survey covered habitats that are expected to exclusively contain long-finned pilot whales.

An abundance estimate of 11,865 (CV=0.57) *Globicephala* sp. was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. Pilot whales were not observed during the aerial portion of the survey. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al*. 2009). The vessel portion of this survey included habitats where both short-finned and long-finned pilot whales occur. The estimated abundance of short-finned pilot whales from this survey was 4,569 (CV-=-0.57).

An abundance estimate of 16,946 (CV=0.43) *Globicephala* sp. was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines was surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break north of Cape Hatteras, North Carolina, with a lower number of sightings over the continental slope in the southern portion of the survey. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). This survey included habitats that are expected to exclusively contain short-finned pilot whales.

Spatial Distribution and Abundance Estimates for *Globicephala macrorhynchus*

Pilot whale biopsy samples were collected during summer months (June-August) from South Carolina to the southern flank of Georges Bank between 1998 and 2007. These samples were identified to species using genetic analysis of mitochondrial DNA sequences. A portion of the mtDNA genome was sequenced from each biopsy sample collected in the field, and genetic species identification was performed through phylogenetic reconstruction of the haplotypes. Samples from stranded specimens that were morphologically identified to species were used to assign clades in the phylogeny to species and thereby identify all survey samples. The probability of a sample being from a short-finned (or long-finned) pilot whale was evaluated as a function of sea surface temperature and water depth using logistic regression. This analysis indicated that the probability of a sample coming from a short-finned pilot whale~~s~~ was near 0 at water temperatures <-22°C, and near 1 at temperatures >25°C. The probability of a short-finned pilot whale also increased with increasing water depth. Spatially, during summer months, this regression model predicts that all pilot whales observed in offshore waters near the Gulf Stream are most likely short-finned pilot whales. The area of overlap between the 2 species occurs primarily along the shelf break off the coast of New Jersey between 38°N and 40°N latitude. This model was used to partition the abundance estimates from surveys conducted during the summer of 2011. The sightings from the southeast shipboard survey covering waters from Florida to central Virginia were predicted to consist entirely of short-finned pilot whales. The aerial portion of the northeast surveys covered the Gulf of Maine and the Bay of Fundy ~~and surveys~~ where the model predicted that only long-finned pilot whales would occur, but no pilot whales were observed. The vessel portion of the northeast survey recorded a mix of both species along the shelf break, and the sightings in offshore waters near the Gulf Stream were predicted to consist predominantly of short-finned pilot whales. The best abundance estimate for short-finned pilot whales is thus the sum of the southeast survey estimate (16,946 [CV=0.43]) and the estimated number of short-finned pilot whales from the northeast vessel survey (4,569 [CV=0.57]). The best available abundance estimate is thus 21,515 (CV=0.37).

Table 1. Summary of abundance estimates for the western North Atlantic ~~*Globicephala* sp.~~short-finned pilot whale by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV

~~Aug 2002~~	~~S. Gulf of Maine to Maine~~	~~5,408~~	~~0.56~~
~~Jun-Aug 2004~~	~~Maryland to Bay of Fundy~~	~~15,728~~	~~0.34~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~21,056~~	~~0.54~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~36,784~~	~~0.34~~
~~Aug 2006~~	~~S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence~~	~~26,535~~	~~0.35~~
~~July-Aug 2007~~	~~N. Labrador to Scotian Shelf~~	~~6,134~~	~~0.28~~
Jun-Aug 2011	central Virginia to Lower Bay of Fundy	4,569	0.57
Jun-Aug 2011	central Florida to central Virginia	16,946	0.43
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	21,515	0.37

~~**Spatial Distribution and Abundance Estimates for *Globicephala macrorhynchus***~~

~~Biopsy samples from pilot whales were collected during summer months (June-August) from South Carolina to the southern flank of Georges Bank between 1998 and 2007. These samples were identified to species using genetic analysis of mitochondrial DNA sequences. A portion of the mtDNA genome was sequenced from each biopsy sample collected in the field, and genetic species identification was performed through phylogenetic reconstruction of the haplotypes. Stranded specimens that were morphologically identified to species were used to assign clades in the phylogeny to species and thereby identify all samples. Based upon the date and location of sample collection, the probability of a sample being from a short-finned (or long-finned) pilot whale was evaluated as a function of sea surface temperature and water depth using logistic regression. This analysis indicated that the probability of a sample coming from a short-finned pilot whales was near 0 at water temperatures < 22°C, and near 1 at temperatures >25°C. The probability of a short-finned pilot whale also increased with increasing water depth. Spatially, during summer months, this habitat model predicts that all pilot whales observed in offshore waters near the Gulf Stream are most likely short-finned pilot whales. The area of overlap between the 2 species occurred primarily along the shelf break off the coast of New Jersey between 38°N and 40°N latitude. This habitat model was used to partition the abundance estimates from surveys conducted during the summer of 2004. The survey covering waters from Florida to Maryland was predicted to consist entirely of short-finned pilot whales. The aerial portion of the northeast survey covering the Gulf of Maine and the Bay of Fundy and surveys conducted in Canadian waters were predicted to consist entirely of long-finned pilot whales. The vessel portion of the northeast survey contained a mix of both species, with the sightings in offshore waters near the Gulf Stream predicted to consist of short-finned pilot whales. The best abundance estimate for short-finned pilot whales is thus the sum of the southeast survey estimate (21,056 [CV=0.54]) and the estimated number of short-finned pilot whales from the northeast vessel survey (3,618 [CV=0.50]). The best available abundance estimate is thus 24,674 (CV=0.45) (Garrison *et al.*, in prep; Garrison *et al.*, in press).~~

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for western North Atlantic *Globicephala macrorhnychus* is ~~24,674~~ 21,515 animals (CV=0.~~45~~37). The minimum population estimate is ~~17,190~~ 15,913.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).~~There are insufficient data to determine population trends for *Globicephala macrorhynchus.*~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. ~~Life history parameters that could be used to estimate net productivity obtained from short-finned pilot whales taken in fisheries off the Pacific coast of Japan. In this region, there are 2 distinct stocks of short-finned pilot whales described as "northern" and "southern" types. There were demonstrable differences in the demographic parameters of these 2 forms perhaps related to habitat differences (Kasuya and Tai 1993). The northern form was generally larger and had a later age at sexual maturity than the southern form. The ranges of values for demographic parameters for both stocks are: calving interval 5.1 – 7.8 years; lactation period about 2.0 – 2.78 years; gestation period approximately 15 months; length at birth 140 – 185 cm; mean length at sexual maturity of 420 – 560 cm for males and 316-400 cm for females; mean age at sexual maturity of 17 years for males and 8 – 9 years for females; and maximum age of 45 for males and 62 for females (Kasuya and Tai 1993).~~

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for short-finned pilot whales is ~~17,190~~ 15,913. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic short-finned pilot whale is ~~172~~ 159.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

Total annual estimated average fishery-related mortality or serious injury during 2007-2011 was 162 pilot whales (CV=0.18; Table 2). Of these, 119 (CV~~=~~0.24) were from the pelagic longline fishery and thus are assigned to short-finned pilot whales exclusively. ~~–~~The total annual human caused mortality of short-finned pilot whales cannot be determined. ~~The total annual human caused mortality of short-finned pilot whales cannot be determined.~~ The highest bycatch rates of undifferentiated pilot whales in the pelagic longline fishery ~~area~~ were observed during September~~–~~ ~~October~~ November along the mid-Atlantic coast (Garrison 2007). Biopsy samples and photo-identification data collected during October-November~~,~~ 2011 in this region indicated that all of the animals observed within the region of pelagic longline bycatch during these months were short-finned pilot whales (NMFS unpub~~.~~lished ~~D~~data). ~~–~~During the remainder of the year, pilot whale bycatch in the pelagic longline fishery was likewise restricted to waters where short-finned pilot whales are expected to occur almost exclusively. ~~-~~Therefore, it is likely that the bycatch of pilot whales in the pelagic longline fishery is restricted to short-finned pilot whales. ~~-~~In bottom trawls and mid-water trawls, mortalities are more generally observed north of 40°N latitude and in areas expected to have a higher proportion of long-finned pilot whales. ~~-~~However, analyses to partition mortality estimates from these fisheries between the two species have not been conducted. ~~, most mortalities were observed in the same area between July and November (Rossman 2010). The model used to derive abundance estimates uses data restricted to the warmest months of the year (June-August), and there are currently very few data available for the potential area of overlap during the fall. Therefore it is not possible to partition mortality estimates between the 2 species because there are very few available genetic samples from the area of overlap and season where most mortality occurs.~~ Mortality and serious injury estimates for bottom and mid-water trawl fisheries are thus presented only for the 2 species combined. ~~Total annual estimated average fishery-related mortality or serious injury during 2005-2009 was 162 pilot whales (CV=0.15; Table 2). Of this, it is most likely that the mortality due to the pelagic longline fishery, the mid-Atlantic midwater trawl fishery, and the mid-Atlantic groundfish fishery have the most direct impact on short-finned pilot whales.~~

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al.* 2008; NOAA 2012). NMFS defines

serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the 2 species of pilot whales in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeastern coast of the U.S. A fishery observer program, which has collected fishery data and information on incidental bycatch of marine mammals, was established in 1977 with the implementation of the Fisheries Conservation and Management Act (FCMA).

During 1977-1991, observers in this program recorded 436 pilot whale mortalities in foreign-fishing activities (Waring *et al.* 1990; Waring 1995). A total of 391 pilot whales (90%) were taken in the mackerel fishery, and 41 (9%) occurred during *Loligo* and *Illex* squid-fishing operations. This total includes 48 documented takes by U.S. vessels involved in joint-venture fishing operations in which U.S. captains transfer their catches to foreign processing vessels. Two animals were also caught in both the hake and tuna longline fisheries (Waring *et al.* 1990).

Between 1989 and 1998, 87 mortalities were observed in the large pelagic drift gillnet fishery. The annual fishery-related mortality (CV in parentheses) was 77 in 1989 (0.24), 132 in 1990 (0.24), 30 in 1991 (0.26), 33 in 1992 (0.16), 31 in 1993 (0.19), 20 in 1994 (0.06), 9.1 in 1995 (0), 11 in 1996 (0.17), no fishery in 1997 and 12 in 1998 (0). This fishery was permanently closed in 1999.

Five pilot whale (*Globicephala* sp.) mortalities were reported in the self-reported fisheries information for the Atlantic tuna pair trawl in 1993. In 1994 and 1995 observers reported 1 and 12 mortalities, respectively. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery in 1994 was 2.0 (CV=0.49) and 22 (CV=0.33) in 1995.

Two interactions with pilot whales in the Atlantic tuna purse seine fishery were observed in 1996. In 1 interaction, the net was pursed around 1 pilot whale, the rings were released and the animal escaped alive, condition unknown. This set occurred east of the Great South Channel and just north of the Cultivator Shoals region on Georges Bank. In a second interaction, 5 pilot whales were encircled in a set. The net was opened prior to pursing to let the whales swim free, apparently uninjured. This set occurred on the Cultivator Shoals region on Georges Bank. No trips were observed during 1997 through 1999. Four trips were observed in September 2001 with no marine mammals observed taken during these trips.

No pilot whales were taken in observed mid-Atlantic coastal gillnet trips during 1993-1997. One pilot whale was observed taken in 1998, and none were observed taken from 1999-2003. Observed effort was scattered between New York and North Carolina from 1 to 50 miles off the beach. All bycatches were documented during January to April. Using the observed takes, the estimated annual mortality attributed to this fishery was 7 in 1998 (CV=1.10).

One pilot whale take was observed in the *Illex* squid portion of the southern New England/mid-Atlantic squid, mackerel, butterfish trawl fisheries in 1996 and 1 in 1998. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was 45 in 1996 (CV=1.27), 0 in 1997, 85 in 1998 (CV=0.65) and 0 in 1999. However, these estimates should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery ~~is~~was included as a component of the mid-Atlantic bottom trawl fishery.

One pilot whale take was observed in the *Loligo* squid portion of the southern New England/mid-Atlantic squid, mackerel, and butterfish trawl fisheries in 1999. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was 0 between 1996 and 1998 and 49 in 1999 (CV=0.97). These estimates should, however, be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery ~~has been~~was included as a component of the mid-Atlantic bottom trawl fishery.

There was 1 observed take in the southern New England/mid-Atlantic bottom trawl fishery reported in 1999. The estimated fishery-related mortality for pilot whales attributable to this fishery was 0 from 1996-1998, and 228 (CV=~~-~~1.03) in 1999. After 1999 this fishery ~~has been~~was included as a component of the mid-Atlantic bottom trawl fishery.

A U.S. joint venture (JV) mid-water (pelagic) trawl fishery was conducted on Georges Bank from August to December 2001. Eight pilot whales were incidentally captured in a single mid-water trawl during JV fishing operations. Three pilot whales were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF).

For more details on the earlier fishery interactions see Waring *et al.* (2007).

Northeast Sink Gillnet

One pilot whale (unidentified to species) was caught in this fishery in 2010. The expanded bycatch estimate was 3 (0.82) in 2010, resulting in a 2007-2011 annual average serious injury and mortality of 1 (0.82).

Pelagic Longline

Most of the estimated marine mammal bycatch in the U.S. pelagic longline fishery was recorded in U.S. Atlantic EEZ waters between South Carolina and Cape Cod (~~Johnson *et al.* 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007; Fairfield and Garrison 2008~~Garrison 2007). Pilot whales are frequently observed to feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). Between 1992 and ~~2008~~2011, ~~154~~ 185 pilot whales were observed released alive, including ~~83~~ 109 that were considered seriously injured, and ~~5~~ 6 mortalities were observed (Johnson *et al.* 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009;~~,~~ Garrison and Stokes~~,~~ 2010; Garrison and Stokes 2012a; Garrison and Stokes~~,~~ 2012b). January-March bycatch was concentrated on the continental shelf edge northeast of Cape Hatteras. Bycatch was recorded in this area during April-June, and takes also occurred north of Hydrographer Canyon ~~off the continental shelf~~ in water over 1,000 fathoms (1830 m) deep during April-June. During the July-September period, takes occurred on the continental shelf edge east of Cape Charles, Virginia, and on Block Canyon slope in over 1,000 fathoms of water. October-December bycatch occurred between the 20- and 50-fathom (37- and 92-m) isobaths between Barnegat Bay and Cape Hatteras.

The estimated fishery-related mortality to pilot whales in the U.S. Atlantic (excluding the Gulf of Mexico) attributable to this fishery was: 127 in 1992 (CV=1.00), 0 from 1993-1998, 93 in 1999 (CV=1.00), 24 in 2000 (CV=1.00), 20 (CV=1.00) in 2001, 2 (CV=1.00) in 2002, 0 in 2003-2005, 16 (CV=1.00) in 2006, ~~and~~ 0 in 2007-2010, and 19 (CV~~=~~-1.00) in 2011. The estimated serious injuries were 40 (CV=0.71) in 1992, 19 (CV=1.00) in 1993, 232 (CV=0.53) in 1994, 345 (CV=~~-~~0.51) in 1995, (includes 37 estimated short-finned pilot whales in 1995 (CV=1.00), 0 from 1996 to 1998, 288 (CV=0.74) in 1999, 109 (CV=1.00) in 2000, 50 in 2001 (CV=0.58), 51 in 2002 (CV=0.48), 21 in 2003 (CV=0.78), 74 in 2004 (CV=0.42), 212 in 2005 (CV=0.21), 169 in 2006 (CV=0.31), 57 (CV=0.47) in 2007, 98 (CV=0.42) in 2008, ~~and~~ 17 (CV~~=~~-0.70) in 2009, 127 (CV~~=~~-0.78) in 2010, and 280 (CV~~=~~-0.29) in 2011. The average ~~'combined'~~ annual total mortality and serious injury in ~~2005-2009~~2007-2011 was ~~114~~ 119 pilot whales (CV=0.~~20~~24) (Table 2). Available seasonal biopsy data and genetic analyses indicate that pilot whale bycatch in the pelagic longline fishery is restricted to short-finned pilot whales.

~~An experimental fishery was conducted on 6 vessels operating in the Gulf of Mexico and off the U.S. East Coast in 2005, with 100% observer coverage achieved. During this experiment, different hook baiting techniques with standardized gangion and float line lengths were used, and hook timers and time-depth recorders were attached to the gear. The fishing techniques and gear employed during this experimental fishery do not represent those used during "normal" sighing efforts, and are thus presented separately in Table 2. Three pilot whales were released alive during this experimental fishery, including 1 that was seriously injured (Fairfield Walsh and Garrison 2006).~~

Mid-Atlantic Bottom Trawl

~~Two pilot whales were observed taken in the mid-Atlantic bottom trawl in 2000, 4 in 2005, 1 in 2006, 0 in 2007, 0 in 2008, and 0 in2009.~~ Seven pilot whales were observed taken in the mid-Atlantic bottom trawl fishery during 2000-2006. No pilot whales were observed taken during 2007-2011. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was: 47 (CV=0.32) in 2000, 39 (CV=0.31) in 2001, 38 (CV=0.36) in 2002, 31 (CV=0.31) in 2003, 35 (CV=0.33) in 2004, 31 (CV=0.31) in 2005, 37 (CV=0.34) in 2006, 37 (CV=0.38) in 2007, 24 (CV=0.36) in 2008, ~~and~~ 23 (CV~~=~~-0.35) in 2009, and 22 (CV~~=~~-0.35) in 2010.

Expanded estimates of fishery mortality for 2011 are not available, and mortalities have not been assigned to species. The 2007-2010 average mortality attributed to the mid-Atlantic bottom trawl was 29 animals (CV=0.19~~) (~~; Table 2).

~~The 2005-2009 average mortality attributed to the mid-Atlantic bottom trawl was 30 animals (CV=0.16) (Table 2).~~

Northeast Bottom Trawl

~~Two pilot whales were observed taken in the Northeast bottom trawl in 2004, 4 in 2005, 1 in 2006,~~Seven pilot whales were observed taken in the Northeast bottom trawl fishery during 2004-2006. ~~-~~New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al*. in prep). ~~-~~Observed serious injuries and mortalities of pilot whales included 4 in 2007, 5 in 2008, 3 in 2009, 10 in 2010, and 12 in 2011. In addition to takes observed by fisheries observers, the Marine Mammal Authorization Program (MMAP) included 2 self-reported incidental takes (mortalities) of pilot whales in bottom trawl gear off Maine and Massachusetts during 2008, and 2 self-reported incidental takes (mortalities) in rule trawl and otter trawl gear off Maine and Rhode Island during 2011. ~~-~~These reports do not contribute to the estimate of mortality from the observer program. The estimated fishery-related mortality to pilot whales in the U.S. Atlantic attributable to this fishery was: 18 (CV=0.29) in 2000, 30 (CV=0.27) in 2001, 22 (CV=0.26) in 2002, 20 (CV=0.26) in 2003, 15 (CV=0.29) in 2004, 15 (CV=0.30) in 2005, 14 (CV=0.28) in 2006, 12 (CV=0.35) in 2007,10 (CV=0.34) in 2008, 9 (CV=0.35) in 2009, and 9 (CV~~-=-~~0.35) in 2010. Expanded estimates of fishery mortality for 2011 are not available, and mortalities have not been assigned to species. ~~-~~The 2007–2010 average mortality attributed to the northeast bottom trawl was 10 animals (CV~~-=-~~0.18~~)~~; ~~(~~Table 2).

Northeast Mid-Water Trawl – Including Pair Trawl

In Sept 2004 a pilot whale was observed taken in the paired mid-water trawl fishery on the northern edge of Georges Bank (off Massachusetts) in a haul that was targeting (and primarily caught) herring. ~~-~~In April 2008, six pilot whale takes were observed in the single mid-water trawl fishery in hauls targeting mackerel and located on the southern edge of Georges Bank. In September 2011, one pilot whale was taken in the mid-water trawl fishery on the northern flank of Georges Bank. Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed pilot whale takes per observed hours the gear was in the water) for each year, where the paired and single Northeast mid-water trawls were pooled and only hauls that targeted herring or mackerel were used. The VTR herring and mackerel data were used to estimate the total effort (~~Palka, pers. comm~~NMFS unpublished data~~.~~). Estimated annual fishery-related mortalities were: unknown in 2001-2002, 0 in 2003, ~~and~~ 5.6 (CV=0.92) in 2004, 0 in 2005 to 2007, 16 (CV=0.61) in 2008, and 0 in 2009 to 2010 (Table 2; ~~Palka pers. comm~~NMFS unpublished data~~.~~). Expanded estimates of fishery mortality for 2011 are not available, and mortalities have not been assigned to species. ~~-~~The average annual estimated mortality during ~~2005-2009~~2007-2010 was ~~3~~ 4 (CV=0.61~~)~~ ~~(~~; Tab-le 2).

Mid-Atlantic Mid-Water Trawl Fishery (Including Pair Trawl)

In March 2007 a pilot whale was observed bycaught in the single mid-water fishery in a haul targeting herring that was south of Rhode Island. Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed pilot whale takes per observed hours the gear was in the water) for each year, where the paired and single Mid-Atlantic mid-water trawls were pooled only hauls that targeted herring or mackerel were used. ~~-~~The VTR herring and mackerel data were used to estimate the total effort (~~Palka, pers. comm~~NMFS unpublished data~~.~~). Estimated annual fishery-related mortalities were unknown in 2002, 0 in 2003 to 2006, 12.1 (CV=0.99) in 2007, and 0 in 2008~~, and 0 in 2009~~-2011 (Table 2~~; Palka pers. com.~~). The average annual estimated mortality during ~~2005-2009~~ 2007-2011 was 2.4 (CV=0.99~~)~~ ~~(~~; Table 2). ~~-~~Mortalities have not been assigned to species.

CANADA

Unknown numbers of long-finned pilot whales have also been taken in Newfoundland and Labrador, and Bay of Fundy groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, and Atlantic Canada cod traps (Read 1994).

Between January 1993 and December 1994, 36 Spanish deep-water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Banks) (Lens 1997). A total of 47 incidental catches was recorded, which included 1 long-finned pilot whale. The incidental mortality rate for pilot whales was 0.007/set.

In Canada, the fisheries observer program places observers on all foreign fishing vessels, on between 25% and 40% of large Canadian vessels (greater than 100 ft), and on approximately 5% of small vessels (Hooker *et al.* 1997). Fishery observer effort off the coast of Nova Scotia during 1991-1996 varied on a seasonal and annual basis, reflecting changes in fishing effort (Hooker *et al.* 1997). During the 1991-1996 periods, long-finned pilot whales

were bycaught (number of animals in parentheses) in bottom trawl (65); midwater trawl (6); and longline (1) gear. Recorded bycatches by year were: 16 in 1991, 21 in 1992, 14 in 1993, 3 in 1994, 9 in 1995 and 6 in 1996. Pilot whale bycatches occurred in all months except January-March and September (Hooker *et al.* 1997).

There was 1 record of incidental catch in the offshore Greenland halibut fishery that involved 1 long-finned pilot whale in 2001 although no expanded bycatch estimate was calculated (Benjamins *et al.* 2007).

~~Table 2. Summary of the incidental mortality and serious injury of pilot whales (*Globicephala* sp.) by commercial fishery including the years sampled (Years), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).~~

~~Fishery~~	~~Years~~	~~Data Type~~ [a]	~~Observer Coverage~~ [b]	~~Observed Serious Injury~~	~~Observed Mortality~~	~~Estimated Serious Injury~~	~~Estimated Mortality~~	~~Estimated Combined Mortality~~	~~Estimated CVs~~	~~Mean Annual Mortality~~
~~Mid-Atlantic Bottom Trawl~~ [c]	~~05-09~~	~~Obs. Data Dealer~~	~~, .03, .02, .03, .03, .05~~	~~0, 0, 0, 0, 0~~	~~4, 1, 0, 0, 0~~	~~0, 0, 0, 0~~	~~31, 37, 36, 24, 23~~	~~31, 37, 36, 24, 23~~	~~.31, .34, .38, .36, .36~~	~~30 (.16)~~
~~Northeast Bottom Trawl~~ [c]	~~05-09~~	~~Obs. Data Dealer Data VTR Data~~	~~.12, .06, .06, .08, .05~~	~~0, 0, 0, 0, 0~~	~~2, 4, 1, 4, 5, 3~~	~~0, 0, 0, 0~~	~~15, 14, 12, 10, 9~~	~~15, 14, 12, 10, 9~~	~~.30, .28, .35, .34, .36~~	~~12 (.14)~~
~~Mid-Altlantic Mid-Water Trawl - Including Pair Trawl~~ [d]	~~05-09~~	~~Obs. Data Dealer Data VTR Data~~	~~.08, .09, .04, .13, .13~~	~~0, 0, 0, 0, 0~~	~~0, 0, 1, 0, 0~~	~~0, 0, 0, 0~~	~~0, 0, 12, 0, 0~~	~~0, 0, 12 ,0, 0~~	~~0, 0,0.99, 0, 0~~	~~2.4 (0.99)~~
~~Northeast Mid-Water Trawl - Including Pair Trawl~~ [d]	~~05-09~~	~~Obs. Data Dealer Data VTR Data~~	~~.20, .03, .08, .20, .42~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 6, 0~~	~~0, 0, 0, 0~~	~~0, 0, 0, 16, 0~~	~~0, 0, 0, 16, 0~~	~~0, 0, 0, .61, 0~~	~~3 (.61)~~
~~Pelagic Longline~~	~~05-09~~	~~Obs. Data Logbook~~	~~.06, .07, .07, .07, .10~~	~~9, 12, 5, 5, 2~~	~~0, 1, 0, 0, 0~~	~~212, 169, 57, 98, 17~~	~~0, 16, 0, 0, 0~~	~~212, 185, 57, 98, 17~~	~~.21, .47, .65, .42, .70~~	~~114 (.20)~~
~~2005 Pelagic Longline experimental fishery~~ [e]	~~05~~	~~Obs. Data~~	~~1~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1(0)~~
~~TOTAL~~										~~162 (.15)~~

[a] ~~Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).~~

[b] ~~Observer coverage of the mid Atlantic coastal gillnet fishery is a ratio based on tons of fish landed. Observer coverage for the longline fishery is a ratio based on sets. The trawl fisheries are ratios based on trips.~~

[c] ~~NE and MA bottom trawl mortality estimates reported for 2007 to 2009 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2007 to 2009 effort. For complete documentation of methods used to estimate cetacean bycatch mortality see Rossman (2010).~~

[d] ~~Within each of the fisheries (Northeast and Mid-Atlantic), the paired and single trawl data were pooled. Ratio estimation methods were used within each fishery and year to estimate the total the annual bycatch.~~

[e] ~~A cooperative research program conducted during quarters 2 and 3 in 2005 (Fairfield Walsh and Garrison 2006).~~

Table 2. Summary of the incidental mortality and serious injury of pilot whales (*Globicephala* sp.) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Data Type[a]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Northeast Sink Gillnet	07-11	Obs. Data, Logbook, Dealer Data	.07, .05, .04, .17, .19	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, 3	0, 0, 0, 0, 3	0, 0, 0, 0, .82	1 (.82)
Northeast Bottom Trawl [b]	07-11	Obs. Data Logbook	.06, .08, .09, .16, .26	1,0,2,0,3	3,5,1,6,9	na	na	12,10,9,9, na	.35,.34,.34, .35, na	10 (.18)
Mid-Atlantic Bottom Trawl [b]	07-11	Obs. Data Logbook	.03, .03, .05, .06, .08	0,0,0,0,0	0,0,0,0,0	0,0,0,0,0	36,24,23, 22, na	36,24,23,22, na	.38,.36,.36 ,.35,na	26 (.19)
Northeast Mid-Water Trawl - Including Pair Trawl [c]	07-11	Obs. Data Dealer Data VTR Data	.08, .20, .42, .41, .17	0,0,0,0,0	0,6,0,0,1	0,0,0,0,0	0,16,0,0, na	0,16,0,0, na	0,.61,0,0, na	4 (.61)
Mid-Altlantic Mid-Water Trawl - Including Pair Trawl[c]	07-11	Obs. Data Dealer Data VTR Data	.04, .13, .13, .25, .41	0,0,0,0,0	1,0,0,0,0	0,0,0,0,0	12,0,0,0,0	12,0,0,0,0	0.99,0,0,0, 0	2.4 (0.99)
Pelagic Longline[c]	07-11	Obs. Data Logbook	.07, .07, .10, .08, .09	5,2,5,5,18	0,0,0,0,1	57, 98, 17, 127, 280	0,0,0,0, 19	57,98,17, 127, 299	.65,.42,.70 ,.78,.29	119 (.24)
TOTAL										162 (.18)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program (NEFOP) and the Southeast Pelagic Longline Observer Program. The NEFOP collects landings data (Weighout), and total landings are used as a measure of total effort for the coastal gillnet fishery. Total observer coverage reported for gillnet and bottom trawl gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery at-sea monitors. For 2010 only the NEFOP observed data were reported in this table, since the at-sea monitoring program just started in May 2010.

[b] Estimates have not been generated for bottom trawl fisheries for 2011. Average annual mortality represents the four year average (2007-2010) for these fisheries. MA and NE bottom trawl fishery mortality estimates presented for 2007-2010 are a product of bycatch rates estimated from a GLM using observer data from 2000 to 2005 and reported effort from 2007-2010. Documentation of methods used to estimate cetacean bycatch mortality is available in Rossman (2010).

[c] Within each of the fisheries (Northeast and Mid-Atlantic), the paired and single trawl data were pooled. Ratio estimation methods were used within each fishery and year to estimate the total the annual bycatch. Expanded estimates for 2011 are not available for these fisheries.

Other Mortality

Pilot whales have a propensity to mass strand throughout their range, but the role of human activity in these events is unknown. Between 2 and 168 pilot whales have stranded annually, either individually or in groups, along the eastern U.S. seaboard since 1980 (NMFS 1993, stranding databases maintained by NMFS NER, NEFSC and SEFSC). From ~~2004-2008~~2007-2011, ~~44~~21 short-finned pilot whales (*Globicephala macrorhynchus*), ~~68~~41 long-finned pilot whales (*Globicephala melas melas*), and ~~11~~6 pilot whales not specified to the species level (*Globicephala* sp.) were reported stranded between Maine and Florida, including ~~Puerto Rico and~~ the Exclusive Economic Zone (EEZ) (Table 3). ~~This includes 1 mass stranding of 18 long-finned pilot whales (including 1 pregnant female) as part of a multi-species mass stranding in Barnstable County, Massachusetts, on 10 December 2005.~~

~~A Virginia Coastal Small Cetacean Unusual Mortality Event (UME) occurred along the coast of Virginia from 1 May to 31 July 2004, when 66 small cetaceans stranded mostly along the outer (eastern) coast of Virginia's barrier islands including 1 pilot whale (*Globicephala* sp.). Human interactions were implicated in 17 of the strandings (1 common and 16 bottlenose dolphins), other potential causes were implicated in 14 strandings (1 Atlantic white-sided dolphin, 2 harbor porpoises and 11 bottlenose dolphins), and no cause could be determined for the remaining strandings, including the pilot whale. A final report on this UME is pending (Barco, in prep.).~~

~~An Offshore Small Cetacean UME, was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. One short-finned pilot whale was involved in this UME.~~

~~A UME mass stranding of 33 short-finned pilot whales, including 5 pregnant females, occurred near Cape Hatteras, North Carolina, from 15-16 January 2005. Gross necropsies were conducted and samples were collected for pathological analyses (Hohn *et al.* 2006), but no single cause for the UME was determined.~~

~~Table 3. Pilot whale (*Globicephala macrorhynchus* [SF], *Globicephala melas melas* [LF] *and Globicephala* sp. [Sp]) strandings along the Atlantic coast, 2005-2009. Strandings that were not reported to species have been reported as *Globicephala* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded pilot whales to species, reports to specific species should be viewed with caution.~~

~~STATE~~	~~2005~~			~~2006~~			~~2007~~			~~2008~~			~~2009~~			~~TOTALS~~		
	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~	~~SF~~	~~LF~~	~~Sp~~
~~Nova Scotia[a]~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~15~~	~~0~~	~~0~~	~~22~~
~~Newfoundland and Labrador[b]~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~2~~	~~7~~
~~Maine[c]~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~3~~	~~0~~	~~0~~	~~8~~	~~1~~
~~New Hampshire~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~
~~Massachusetts[d]~~	~~0~~	~~22~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~6~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~4~~	~~0~~	~~0~~	~~35~~	~~1~~
~~Rhode Island~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~4~~	~~0~~

~~New York~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~6~~	~~0~~
~~New Jersey~~	~~0~~	~~0~~	~~2~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~	~~1~~	~~0~~	~~2~~	~~3~~	~~2~~
~~Delaware~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~
~~Maryland~~	~~0~~	~~4~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~
~~Virginia[e]~~	~~0~~	~~4~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~6~~	~~0~~
~~North Carolina[f]~~	~~35~~	~~1~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~1~~	~~2~~	~~0~~	~~0~~	~~40~~	~~1~~	~~4~~
~~South Carolina~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~Florida~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~EEZ~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~
~~TOTALS - U.S., Puerto Rico, & EEZ~~	~~35~~	~~35~~	~~4~~	~~1~~	~~6~~	~~1~~	~~0~~	~~10~~	~~0~~	~~3~~	~~7~~	~~4~~	~~4~~	~~11~~	~~0~~	~~43~~	~~69~~	~~9~~

~~[a] Data supplied by Tonya Wimmer, Nova Scotia Marine Animal Response Society (pers. comm.).~~

~~[b] (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010).~~

~~[c] Long-finned pilot whale stranded in Maine in 2007 released alive.~~

~~[d] Includes 18 pilot whales which were part of a multi-species mass stranding in Brewster on 10 December 2005. One of the strandings in 2007 classified as human interaction due to attempts to herd the animal to deeper water. One of the 2009 animals was classified as a fishery interaction.~~

~~[e] One pilot whale stranded in Virginia in 2004 during an Unusual Mortality Event but was not identified to species (decomposed and decapitated). Sign of human interaction (a line on the flukes) observed on 2 animals in 2005, and 1 animal was a pregnant female.~~

~~[f] In 2004, 1 short-finned pilot whale (September) and 1 pilot whale (November) not identified to species stranded in North Carolina during an Unusual Mortality Event (UME). A long-finned pilot whale also stranded in February, not related to any UME. 2005 includes Unusual Mortality Event mass stranding of 33 short-finned pilot whales on 15-16 January, 2005, including 5 pregnant females. Six animals had fishery interaction marks, which were healed and not the cause of death. Signs of fishery interaction observed on a short-finned pilot whale stranded in May 2005.~~

Table 3. Pilot whale (*Globicephala macrorhynchus* [SF], *Globicephala melas melas* [LF] *and Globicephala* sp. [Sp]) strandings along the Atlantic coast, 2007-2011. Strandings that were not reported to species have been reported as *Globicephala* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded pilot whales to species, reports to specific species should be viewed with caution.

STATE	2007			2008			2009			2010			2011			TOTALS		
	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp
Nova Scotia[a]	0	0	2	0	0	0	0	0	15	0	0	11	0	0	19	0	0	47
Newfoundland and Labrador[b]	0	0	1	0	0	2	0	0	1	0	0	1	0	0	8	0	0	13
Maine[c]	0	1	0	0	1	0	0	3	0	0	0	0	0	1	0	0	6	0
Massachusetts[d]	0	6	0	0	1	0	0	4	0	0	2	0	3	4	0	3	17	0
Rhode Island	0	0	0	0	2	0	0	2	0	0	0	0	0	2	0	0	6	0
New York[e]	0	2	0	0	5	0	0	1	0	0	0	0	0	1	0	0	9	0
New Jersey	0	1	0	0	1	0	1	1	0	0	0	0	1	0	1	2	3	1
Delaware	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Virginia	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	2
North Carolina[f]	0	0	0	3	0	1	2	0	0	1	0	0	1	0	0	7	0	1
South Carolina	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	2

Florida[g]	0	0	0	0	0	0	0	0	0	4	0	0	2	0	0	6	0	0
TOTALS - U.S. & EEZ	0	10	0	3	10	2	4	11	0	5	2	3	7	8	1	19	41	6

[a] Data supplied by Nova Scotia Marine Animal Response Society (pers. comm.). Strandings in 2011 include one mass stranding of 6-8 whales (one of which died) and 2 animals with ropes tied around their tail stocks.
[b] (Ledwell and Huntington 2006; 2007; 2008; 2009; 2010; 2012; Ledwell *et al.* 2011). 2011 included 2 mom/calf pairs. Not included in 2011 total was group of 6 pilot whales shepherded out a narrow channel.
[c] Long-finned pilot whale stranded in Maine in 2007 released alive.
[d] One of the strandings in 2007 classified as human interaction due to attempts to herd the animal to deeper water. One of the 2008 animals classified as a fishery interaction due to line markings and cut flukes. One of the 2009 animals was classified as a fishery interaction. One of the 2010 animals released alive. One of the strandings in 2011 was classified as a human interaction due to attempts by public to push the animal back into the water.
[e] Two of the 2008 strandings were classified as human interactions.
[f] Signs of fishery interaction observed on a short-finned pilot whale stranded in Feb 2010.
[g] One of the 2010 animals released alive.

Short-finned pilot whales strandings (*Globicephala macrorhynchus*) have been reported as far north as Nova Scotia (1990), ~~and~~ Block Island, Rhode Island (2001), and Cape Cod, Massachusetts (2011), though the majority of the strandings occurred from North Carolina southward (Table 3). Long-finned pilot whales (*Globicephala melas*) have been reported stranded as far south as Florida, when 2 long-finned pilot whales were reported stranded in Florida in November 1998, though their flukes had been apparently cut off, so it is unclear where these animals actually may have died. One additional long-finned pilot whale stranded in South Carolina in 2003, though the confidence in the species identification was only moderate. This animal has subsequently been sequenced and mitochondrial DNA analysis supports the long-finned pilot whale identification. ~~Most of the remaining~~Recent long-finned pilot whale strandings were from ~~North Carolina~~New Jersey northward (Table 3).

During ~~2005-2009~~2007-2011, several human and/or fishery interactions were documented in stranded pilot whales. ~~During a UME in Dare, North Carolina, in January 2005, 6 of the 33 short-finned pilot whales which mass stranded had fishery interaction marks (specifics not given) that were healed and determined not to be the cause of death. A short-finned pilot whale stranded in May 2005 in North Carolina had net marks around the leading edge of the dorsal fin from the top to bottom, and had net marks on both fluke lobes.~~ In 2008, 1 Massachusetts stranding mortality was deemed a fishery interaction due to line markings and cut flukes. Also in 2008, 2 of the New York strandings of long-finned pilot whales were classified as human interactions. One long-finned pilot whale that stranded in Massachusetts in 2009 was classified as a ~~human~~fishery interaction because it had a piece of monofilament line in its stomach. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

A potential human-caused source of mortality is from polychlorinated biphenyls (PCBs) and chlorinated pesticides (DDT, DDE, dieldrin, etc.), moderate levels of which have been found in pilot whale blubber (Taruski *et al.* 1975; Muir *et al.* 1988; Weisbrod *et al.* 2000). Weisbrod *et al.* (2000) reported that bioaccumulation levels were more similar in whales from the same stranding group than animals of the same sex or age. Also, high levels of toxic metals (mercury, lead, cadmium) and selenium were measured in pilot whales harvested in the Faroe Island drive fishery (Nielsen *et al.* 2000). Similarly, Dam and Bloch (2000) found very high PCB levels in pilot whales in the Faroes. The population effect of the observed levels of such contaminants is unknown.

STATUS OF STOCK

~~The status of short-finned pilot whales relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine population trends for this species.~~ The ~~western North Atlantic~~ short-finned pilot whale ~~The species~~ is not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The total U.S. fishery-related

mortality and serious injury for short-finned pilot whales is unknown, since it is not possible to fully partition mortality estimates between the long-finned and short-finned pilot whales, and mortality estimates for the bottom and mid-water trawl fisheries are not available for 2011. -The total mortality and serious injury attributed to short-finned pilot whales in the pelagic longline fishery exceeds However, it is most likely not less than 10% of the calculated PBR and therefore cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The total fishery mortality does not It is unknown if total fishery mortality exceeds PBR. While ; and some portion of the mortality impacts long-finned pilot whales. Therefore, tTthis is not currently a strategic stock,. However, the inability to partition mortality estimates in the midwater and bottom trawl fisheries between the species limits the ability to adequately assess the status of this stock, and -there is a risk that fishery mortality approaches PBR if a significant portion of the mortality in the trawl fisheries impacts short-finned pilot whales. -The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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ATLANTIC WHITE-SIDED DOLPHIN (*Lagenorhynchus acutus*): ~~-~~Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

White-sided dolphins are found in temperate and sub-polar waters of the North Atlantic, primarily in continental shelf waters to the 100-m depth contour. In the western North Atlantic the species inhabits waters from central West Greenland to North Carolina (about 35˚N) and perhaps as far east as 29˚W in the vicinity of the mid-Atlantic Ridge (Evans 1987; Hamazaki 2002; Doksaeter *et al.* 2008; Waring *et al.* 2008). Distribution of sightings, strandings and incidental takes suggest the possible existence of three stock units: Gulf of Maine, Gulf of St. Lawrence and Labrador Sea stocks (Palka *et al.* 1997). Evidence for a separation between the population in the southern Gulf of Maine and the Gulf of St. Lawrence population comes from a virtual absence of summer sightings along the Atlantic side of Nova Scotia. This was reported in Gaskin (1992), is evident in Smithsonian stranding records, in Canadian/west Greenland bycatch data (Stenson *et al.* 2011) and was obvious during abundance surveys conducted in the summers of 1995, 1999 and 2004, which covered waters from Virginia to the Gulf of St. Lawrence and during the Canadian component of the Trans-North Atlantic Sighting Survey~~TNASS~~ survey in the summer of 2007 (Lawson and Gosselin 2009). White-sided dolphins were seen frequently in Gulf of Maine waters and in waters at the mouth of the Gulf of St. Lawrence, but only a relatively few sightings were recorded between these two regions.

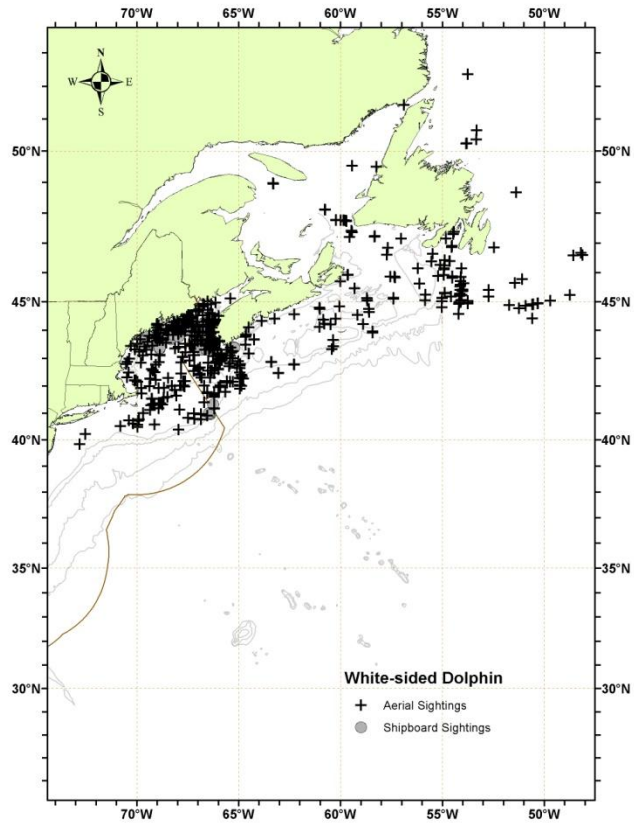

Figure 1. *Distribution of white-sided dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011, and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

The Gulf of Maine population of white-sided dolphins is most common in continental shelf waters from Hudson Canyon (approximately 39˚N) on to Georges Bank, and in the Gulf of Maine and lower Bay of Fundy. Sighting~~s~~ data indicate seasonal shifts in distribution (Northridge *et al.* 1997). During January to May, low numbers of white-sided dolphins are found from Georges Bank to Jeffreys Ledge (off New Hampshire), with even lower numbers south of Georges Bank, as documented by a few strandings collected on beaches of Virginia to~~and~~ South~~North~~ Carolina. From June through September, large numbers of white-sided dolphins are found from Georges Bank to the lower Bay of Fundy. From October to December, white-sided dolphins occur at intermediate densities from southern Georges Bank to southern Gulf of Maine (Payne and Heinemann 1990). Sightings south of Georges Bank, particularly around Hudson Canyon, occur year round but at low densities. The Virginia and North Carolina observations appear to represent the southern extent of the species' range during the winter months. O~~Though on~~ 4 May 2008 a stranded 17-year old male white-sided dolphin with severe pulmonary distress and reactive lymphadenopathy stranded in South Carolina (Powell *et al.* 2011). ~~It is currently not known if~~ In the absence of additional strandings or sightings, this stranding ~~indicates a spatial shift or is~~ seems to be an out-of-range anomaly. The seasonal spatial distribution of this species appears to be

changing during the last few years. These spatial-temporal patterns are currently being investigated to document the magnitude of these apparent changes.

Recent stomach content analysis of both stranded and incidentally caught white-sided dolphins in U.S. waters~~,~~ determined that the predominant prey were silver hake (*Merluccius bilinearis*), spoonarm octopus (*Bathypolypus bairdii*), and haddock (*Melanogrammus aeglefinus*). Sand lances (*Ammodytes* spp.) were only found in the stomach of one stranded white-sided dolphin ~~*L. acutus*~~. Seasonal variation in diet was indicated; pelagic Atlantic herring (*Clupea harengus*) was the most important prey in summer, but was rare in winter (Craddock *et al.* 2009).

POPULATION SIZE

Abundance estimates of white-sided dolphins from various portions of their range are available from: spring, summer and autumn 1978–1982; July–September 1991–1992; June–July 1993; July–September 1995; July–August 1999; August 2002; June–July 2004; August 2006; ~~and~~ July–August 2007; and July–August 2011. The best available current abundance estimate for white-sided dolphins in the western North Atlantic stock is the result of the 2011 survey: ~~—~~48,819 (CV= 0.61). ~~However, because of the apparent changes in the seasonal distribution of this species, the best available abundance estimate may come from one of the non-summer abundance surveys that will be conducted in 2011-2012~~.

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates.

Recent surveys and abundance estimates

~~An abundance estimate of 2,330 (CV=0.80) white-sided dolphins was obtained from a line transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 6,180 km of trackline from the 100-m depth contour on southern Georges Bank to the lower Bay of Fundy. The Scotian shelf south of Nova Scotia was not surveyed (Table 1). Shipboard data were collected using the two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line- transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of aerial g(0) was derived from the pooled 2002, 2004 and 2006 aerial survey data.~~

~~—~~An abundance estimate of 17,594 (CV=0.30) white-sided dolphins was generated from an aerial survey conducted in August 2006 that surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. Data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of g(0) was derived from the pooled 2002, 2004 and 2006 aerial survey data (Table 1; NMFS 2006).

An abundance estimate of 24,422 (CV=0.49) white-sided dolphins was generated from the Canadian Trans-North Atlantic Sighting Survey in July–August 2007. This aerial survey covered ~~an area~~waters from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (MRDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (~~2007~~1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 48,819 (CV=0.61) white-sided dolphins was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of central Virginia~~North Carolina~~ to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a ~~two-simultaneous-team~~double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the ~~mark-recapture distance sampling (~~MRDS~~)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

No white-sided dolphins were detected in ~~A~~the~~n~~ aerial and ship abundance surveys that were~~ was~~ conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology~~two independent visual teams~~ searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. ~~in the southern U.S. waters (from Virginia~~~~North Carolina to Florida).~~ ~~The abundance estimates from this southern survey are being calculated and are not available at this time.~~

Table 1. Summary of recent abundance estimates for western North Atlantic stock of white-sided dolphins (*Lagenorhynchus acutus*). Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Jul 2004~~	~~Gulf of Maine to lower Bay of Fundy~~	~~2,330~~	~~0.80~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	17,594	0.30
Jul-Aug 2007	N. Labrador to Scotian Shelf	24,422	0.49
Jun-Aug 2011	~~North Carolina~~Central Virginia to lower Bay of Fundy	48,819	0.61

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for the western North Atlantic stock of white-sided dolphins is 48,819 (CV=0.61). The minimum population estimate for these white-sided dolphins is 30,403.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).
~~Population trends for this species are currently being investigated and will be reported when completed~~~~A trend analysis has not been conducted for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: calving interval is 2-3 years; lactation period is 18 months; gestation period is 10-12 months and births occur from May to early August, mainly in June and July; length at birth is 110 cm; length at sexual maturity is 230-240 cm for males, and 201-222 cm for females; age at sexual maturity is 8-9 years for males and 6-8 years for females; mean adult length is 250 cm for males and 224 cm for females (Evans 1987); and maximum reported age for males is 22 years and for females, 27 years (Sergeant *et al.* 1980).

For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 30,403. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery

factor, which accounts for endangered, depleted, threatened, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 and the status of the stock relative to OSP is unknown (Wade and Angliss 1997). PBR for the western North Atlantic stock of white-sided dolphin is 304.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during ~~2006~~2007–~~2010~~ 2011 was ~~212 (CV=0.13)~~117 (CV=0.17) white-sided dolphins (Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

NMFS observers in the Atlantic foreign mackerel fishery reported 44 takes of Atlantic white-sided dolphins incidental to fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring *et al.* 1990; NMFS unpublished data). Of these animals, 96% were taken in the Atlantic mackerel fishery. This total included~~s~~ 9 documented takes by U.S. vessels involved in joint-venture (JV) fishing operations in which U.S. captains transferred their catches to foreign processing vessels. No incidental takes of white-sided dolphins were observed in the Atlantic mackerel JV fishery when it was observed in 1998.

During 1991 to 1998, two white-sided dolphins were observed taken in the Atlantic pelagic drift gillnet fishery, both in 1993. Estimated annual fishery-related mortality and serious injury (CV in parentheses) was 4.4 (.71) in 1989, 6.8 (.71) in 1990, 0.9 (.71) in 1991, 0.8 (.71) in 1992, 2.7 (0.17) in 1993 and 0 in 1994, 1995, 1996, and 1998. There was no fishery during 1997 and the fishery was permanently closed in 1999.

A U.S. JV mid-water (pelagic) trawl fishery was conducted during 2001 on Georges Bank from August to December. No white-sided dolphins were incidentally captured. Two white-sided dolphins were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF). During TALFF fishing operations all nets fished by the foreign vessel are observed. The total mortality attributed to the Atlantic herring JV and TALFF mid-water trawl fisheries in 2001 was two animals.

The mid-Atlantic gillnet fishery occurs year round from New York to North Carolina and has been observed since 1993. One white-sided dolphin was observed taken in this fishery during 1997. None were observed taken in other years. The estimated annual mortality (CV in parentheses) attributed to this fishery was 0 for 1993 to 1996, 45 (0.82) for 1997, 0 for 1998 to 2001, unknown in 2002 and 0 in 2003-~~2010~~2011.

Three white-sided dolphins were observed taken in northeast mid-water paired trawls. Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001–2002, 22 (0.97) in 2003, 0 in 2004, 9.4 (1.03) in 2005, and 0 in 2006 -~~to~~ ~~2010~~2011.

U.S.

Northeast Sink Gillnet

Estimated annual white-sided dolphin mortalities (CV in parentheses) attributed to the Northeast sink gillnet fishery were 49 (0.46) in 1991, 154 (0.35) in 1992, 205 (0.31) in 1993, 240 (0.51) in 1994, 80 (1.16) in 1995, 114 (0.61) in 1996 (Bisack 1997), 140 (0.61) in 1997, 34 (0.92) in 1998, 69 (0.70) in 1999, 26 (1.00) in 2000, 26 (1.00) in 2001, 30 (0.74) in 2002, 31 (0.93) in 2003, 7 (0.98) in 2004, 59 (0.49) in 2005, and 41 (0.71) in 2006~~,~~. New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al*. in prep). Estimated fishery-related~~Total observed~~ serious injury and mortality were 0 in 2007, 81 (0.57) in 2008, 0 in 2009, 66 (~~1.0~~0.92) in 2010, and 21 (0.51) in 2011 (Table 2; Orphanides 2013). Average annual estimated fishery-related mortality during ~~2006~~2007–~~2010~~ 2011 was ~~38~~ 34 white-sided dolphins per year (0.~~46~~48; Table 2).

Northeast Bottom Trawl

White-sided dolphin mortalities documented between 1991 and ~~2010~~ 2006~~11~~ in the Northeast bottom trawl fishery were 1 during 1992, 0 in 1993, 2 in 1994, 0 in 1995-2001, 1 in 2002, 12 in 2003, 16 in 2004, 47 in 2005, and 4 in 2006. New serious injury criteria were applied to all observed interactions retroactive back to 2007 (Waring *et al*. in prep). Total observed serious injury and mortality were~~,~~ ~~1~~2 in 2007, 3 in 2008, 31 in 2009, ~~and~~ ~~5~~10 in 2010 and 47 in 2011 (Table 2). Estimated annual fishery-related mortalities (CV in parentheses) were 110 (0.97) in 1992, 0 in 1993, 182 (0.71) in 1994, 0 in 1995–1999, 137 (0.34) in 2000, 161 (0.34) in 2001, 70 (0.32) in 2002, 216 (0.27) in 2003, 200 (0.30) in 2004, 213 (0.28) in 2005, and ~~164~~ 40 (0.~~34~~50) in 2006.~~,~~ Estimated fishery-related serious injury and mortality were ~~147~~29 (0.66~~35~~) in 2007, 1~~4~~7 (0.~~32~~57) in 2008, 1~~31~~52 (0.2~~6~~7) in 2009, ~~and 119~~ 43 (0.~~39~~31) in 2010, and 125 (0.20) in 2011. The ~~2006~~2007~~-2010~~ 2011 average mortality attributed to the Northeast bottom trawl was ~~142~~73 animals (0.15; Table 2).

Mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

In March 2005, five white-sided dolphins were observed taken in paired trawls targeting mackerel that were off Virginia. In February 2006, three animals were observed taken in mackerel paired mid-water trawls north of Hudson Canyon. In March 2007, an animal was observed taken in a mackerel single mid-water trawl near Hudson Canyon. In January and February 2008 three animals were observed in herring single mid-water trawls north of Hudson Canyon. In March 2009 an animal was observed in a pair trawl targeting mackerel south of Hudson Canyon. No white-sided dolphin interactions with this fishery were observed in 2010 or in 2011. Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed white-sided dolphin takes per observed hours the gear was in the water) for each year, where the paired and single mid-Atlantic mid-water trawls were pooled and only hauls that targeted herring and mackerel were used. The VTR herring and mackerel data were used to estimate the total effort in the bycatch estimate (Palka, pers. comm.). Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001-2002, 0 in 2003, 22 (0.99) in 2004, 58 (1.02) in 2005, 29 (0.74) in 2006, 12 (0.98) in 2007, 15 (0.73) in 2008, 4 (0.92) in 2009, and 0 in 2010 and 2011. (Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during ~~2006~~2007~~-2010~~ 2011 was 6~~12~~ (~~0.45~~0.53; Table 2).

Mid-Atlantic Bottom Trawl Fishery

One white-sided dolphin incidental take was observed in 1997, resulting in a mortality estimate of 161 (CV=1.58) animals. No takes were observed from 1998 through 2004 or in 2006 or 2008–2011~~0~~; one take was observed in 2005 and 2 in 2007. New serious injury criteria were applied to all observed interactions retroactive back to 2007. There were no observed serious injuries of white-sided dolphins in the Mid-Atlantic region. Estimated annual fishery-related mortalities (CV in parentheses) were 27 (0.17) in 2000, 27 (0.19) in 2001, 25 (0.17) in 2002, 31 (0.25) in 2003, 26 (0.20) in 2004, 38 (0.29) in 2005, ~~26~~3 (0.~~25~~53) in 2006, ~~,~~ ~~2~~1 (~~0~~1.~~24~~03) in 2007, 1~~6~~ (0.70~~18~~) in 2008, ~~16~~5 (0.~~16~~34) in 2009, ~~and~~ ~~2~~2 (0.~~1~~45) in 2010, and 8 (0.28) in 2011. The 200~~6~~7–201~~0~~1 average mortality attributed to the mid-Atlantic bottom trawl fishery was ~~20~~ 4 animals (0.~~09~~20; Table 2).

Table 2.—Summary of the incidental mortality of white-sided dolphins (*Lagenorhynchus acutus*) by commercial fishery including the years sampled ~~(Years)~~, the type of data used ~~(Data Type)~~, the annual observer coverage ~~(Observer Coverage)~~, the serious injuries and mortalities recorded by on-board observers ~~(Observed Mortality)~~, the estimated annual serious injury and mortality ~~(Estimated Mortality)~~, the estimated CV of the combined annual mortality ~~(Estimated CVs)~~ and the mean annual mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Combined Annual Mortality
Northeast Sink Gillnet[d]	~~06~~07-~~10~~11	Obs. Data Weighout Trip Logbook	~~.04,~~ .07, .05, .04, .17, .19	0, 0, 0, 1, 0	~~2,~~ 0, 4, 0, 6, 5	0, 5, 0, 4, 1	~~41, 0, 81, 0, 66, 21~~ 0, 76, 0, 62, 20	0, 81, 0, 66, 21	~~.71,~~ 0, .57, 0, ~~.1.0~~.92, .51	~~38~~ 34 (~~0.46~~0.46)
Northeast Bottom Trawl[c]	~~06~~07-~~10~~11	Obs. Data ~~Weighout~~ Trip	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 0, 2	~~4, 21~~, 3, 31, ~~5~~10, 45	1, 0, 3, 1, 3	~~164, 147, 147, 131, 119~~	29, 17, 152, 43, 125	~~.34, .35, .32, .26, .39~~	~~142 (0.15)~~ 73 (0.15)

		Logbook					28, 17, 149, 42, 122		.66, .57, .27, .31, .20	
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	0607-1011	Obs. Data Weighout Trip Logbook	.089, .039, .133, .132, .25, .41	0, 0, 0, 0, 0	3, 1, 3, 1, 0, 0	0, 0, 0, 0, 0	29, 12, 15, 4, 0, 012, 15, 4, 0, 0	12, 15, 4, 0, 0	.74, .98, .73, .92, 0, 0	126 (0.450.53)
Mid-Atlantic Bottom Trawl[c]	0607-1011	Obs. Data Weighout Trip Logbook	.02, .03, .03, .05, .06, .08	0, 0, 0, 0, 0	0, 2, 0, 0, 0, 0	0, 0, 0, 0, 0	26, 21, 16, 16, 222, 1, 5, 2, 8	2, 1, 5, 2, 8	.25, .24, .18, .16, .14 1.03, .70, .34, .45, .28	20 (.09) 4 (0.20)
Total										212117 (0.13)(0.17)

a Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Observer Program and At-sea Monitoring Program. NEFSC collects seafood dealer landings data (Weighout) that are used as a measure of total effort in the Northeast gillnet fishery. Mandatory Vessel Trip Report (VTR) (Trip Logbook) data are used to determine the spatial distribution of fishing effort in the sink gillnet, bottom trawl and fishery and in the two mid-water trawl fisheries. In addition, the Trip Logbooks are the primary source of the measure of total effort (soaktow duration) in the mid-water and bottom trawl fisheries.

b Observer coverages for the Northeast sink gillnet is defined as the are ratios of observed to total based on metric tons of fish landed and the ratio of observed to total trips for the gillnet and bottom trawl fisheries, respectively. Observer coverages of the trawl fisheries are ratios based on trips. Beginning in May 2010 Ttotal observer coverage reported for bottom trawl and gillnet gear in the year 2010 includes samples collected from the at-sea monitoring program in addition to traditional fisheries observers coverage in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP). In the Northeast region 437 and 658 trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 trips were sampled by observers and monitors, respectively.

c NE and MA bottom trawl mortality estimates reported for 20087-2010 01 are a product of generalized additive model GLM estimated bycatch rates (utilizing observer data collected from 2006 to 2005 11; Rossman 2010) and effort collected from the respective year, 2007 8-2011 0.

d After 1998, a weighted bycatch rate was applied to effort from both pingered and non-pingered hauls within the stratum where white-sided dolphins were observed taken. During the years 1997, 1999, 2001, 2002, and 2004, respectively, there were 2, 1, 1, 1, and 1 observed white-sided dolphins taken on pingered trips. No takes were observed on pinger trips during 1995, 1996, 1998, 2000, 2005 through 2007. Three of the 2008 takes were on non-pingered hauls and the fourth take was recorded as pinger condition unknown. Of the six 2010 observed takes, 4 were in pingered nets and 2 in non-pingered nets. Four of the 2011 takes were in pingered nets.

CANADA

There is little information available that quantifies fishery interactions involving white-sided dolphins in Canadian waters. Two white-sided dolphins were reported caught in groundfish gillnet sets in the Bay of Fundy during 1985 to 1989, and 9 were reported taken in West Greenland between 1964 and 1966 in the now non-operational salmon drift nets (Gaskin 1992). Several (number not specified) were also taken during the 1960s in the now non-operational Newfoundland and Labrador groundfish gillnets. A few (number not specified) were taken in an experimental drift gillnet fishery for salmon off West Greenland which took place from 1965 to 1982 (Read 1994).

Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in Canadian waters, on 25-40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. Bycaught marine mammals were noted as weight in kilos rather than by the numbers of animals caught. Thus the number of individuals was estimated by dividing the total weight per species per trip by the maximum recorded weight of each species. During 1991 through 1996, an estimated 6 white-sided dolphins were observed taken. One animal was from a longline trip south of the Grand Banks (43º 10'N 53º 08'W) in November 1996 and the other 5 were taken in the bottom trawl fishery off Nova Scotia in the Atlantic Ocean; 1 in July 1991, 1 in April 1992, 1 in May 1992, 1 in April 1993, 1 in June 1993 and 0 in 1994 to 1996.

Estimation of small cetacean bycatch for Newfoundland fisheries using data collected during 2001 to 2003

(Benjamins *et al.* 2007) indicated that, while most of the estimated 862 to 2,228 animals caught were harbor porpoises, a few were white-sided dolphins caught in the Newfoundland nearshore gillnet fishery and offshore monkfish/skate gillnet fisheries.

Herring Weirs

During the last several years, one white-sided dolphin was released alive and unharmed from a herring weir in the Bay of Fundy (A. Westgate, pers. comm.). Due to the formation of a cooperative program between Canadian fishermen and biologists, it is expected that most dolphins and whales will be able to be released alive. Fishery information is available in Appendix III.

Other Mortality

U.S.

During ~~2006~~2007-~~2010~~ 2011 there were ~~218~~ 202 documented Atlantic white-sided dolphin strandings on the U.S. Atlantic coast (Table 3). Forty-two of these animals were released alive. Human interaction was indicated in ~~11~~ 12 records during this period. Of these, two were classified as fishery interactions.

Mass strandings involving up to a hundred or more animals at one time are common for this species. The causes of these strandings are not known. Because such strandings have been known since antiquity, it could be presumed that recent strandings are a normal condition (Gaskin 1992). It is unknown whether human causes, such as fishery interactions and pollution, have increased the number of strandings. In an analysis of mortality causes of stranded marine mammals on Cape Cod and southeastern Massachusetts between 2000 and 2006, Bogomolni *et al.* (2010) found 69% (46 of 67) of stranded white-sided dolphins were involved in mass-stranding events with no significant findings, and 21% (14 of 67) were classified as disease related.

An Unusual Mortality Event ~~(UME)~~ was declared in 2008 due to a relatively high number of strandings between January and April 2008, from New Jersey to North Carolina. Five white-sided dolphins were involved in this event (http://www.nmfs.noaa.gov/pr/health/mmume/midatlantic2008.htm, accessed 19 April 2011).

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

CANADA

Small numbers of white-sided dolphins have been hunted off southwestern Greenland and they have been taken deliberately by shooting elsewhere in Canada (Reeves *et al.* 1999). The Nova Scotia Stranding Network documented whales and dolphins stranded on the coast of Nova Scotia during 1991 to 1996 (Hooker *et al.* 1997). Researchers with Dept. of Fisheries and Oceans ~~(DFO)~~, Canada documented strandings on the beaches of Sable Island during 1970 to 1998 (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. White-sided dolphins stranded at nearly all times of the year on the mainland and on Sable Island. On the mainland of Nova Scotia, a total of 34 stranded white-sided dolphins was recorded between 1991 and 1996: 2 in 1991 (August and October), 26 in July 1992, 1 in Nov 1993, 2 in 1994 (February and November), 2 in 1995 (April and August) and 2 in 1996 (October and December). During July 1992, 26 white-sided dolphins stranded on the Atlantic side of Cape Breton. Of these, 11 were released alive and the rest were found dead. Among the rest of the Nova Scotia strandings, one was found in Minas Basin, two near Yarmouth and the rest near Halifax. On Sable Island, 10 stranded white-sided dolphins were documented between 1991 and 1998; all were males, 7 were young males (< 200 cm), 1 in January 1993, 5 in March 1993, 1 in August 1995, 1 in December 1996, 1 in April 1997 and 1 in February 1998.

Whales and dolphins stranded between 1997 and 2009 on the coast of Nova Scotia as recorded by the Marine Animal Response Society ~~(MARS)~~ and the Nova Scotia Stranding Network are as follows (Table 3): 0 white-sided dolphins stranded in 1997 to 2000, 3 in September 2001 (released alive), 5 in November 2002 (4 were released alive), 0 in 2003, 19-24 in 2004 (15-20 in October (some (unspecified) were released alive) and 4 in November were released alive), 0 in 2005, and 1 in 2006, 8-10 in 2007 (all but 3 released alive), 3 (one released alive) in 2008, 4 (3 released alive) in 2009, ~~and~~ 2 in 2010, and 6 (2 released alive) in 2011 (T. Wimmer, pers. comm.).

White-sided dolphins recorded by the Whale Release and Strandings Program in Newfoundland and Labrador are as follows: 1 animal (released alive) in 2004, 1 in 2005 (dead), 3 in 2006 (all dead), 1 in 2007 (released alive) 2 in 2008 (one released alive and one dead), 3 (all dead) in 2009, ~~and~~ 2 (one released alive and one dead) in 2010, and

0 in 2011 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010; 2011, 2012).

Table 3. White-sided dolphin (*Lagenorhynchus acutus*) reported strandings along the U.S. and Canadian Atlantic coast, 2007-2011.

Area						**Total**
	2007	2008	2009	2010	2011	
Maine	1	1	1	1	2	6
New Hampshire	0	0	1	0	0	1
Massachusetts[a,b]	18	33	22	50	42	165
Rhode Island	0	0	1	0	1	2
Connecticut	0	1	1	0	0	2
New York[c]	5	1	3	1	0	10
New Jersey	0	0	2	0	1	3
Delaware	0	0	1	0	1	2
Maryland	0	1	0	0	1	2
Virginia	0	1	0	0	0	1
North Carolina	1	3	1	0	1	6
South Carolina[b]	0	1	0	0	0	1
Georgia	0	0	0	0	1	1
TOTAL US	**25**	**42**	**33**	**52**	**50**	**202**
Nova Scotia	9	3	4	2	6	24
Newfoundland and Labrador	1	2	3	2	0	8
GRAND TOTAL	35	47	40	56	56	234

[a] Records of mass strandings in Massachusetts during this period are: January 2007 - 9 animals (3 released alive); September 2007 - 3 animals; January 2008 -17 animals, February 2008 - 3 animals (2 released alive); September 2009 - 3 events of 2, 3 and 4 animals (all but 1 released alive); April 2009 - 3 animals (all released alive); March 2010 - 7 animals (one dead calf, 6 adults released alive), 16 animals (5 dead, 11 released alive) and 3 animals (one released alive); April 2010 - 2 animals (released alive); July 2010 - 2 animals (released alive); March 2011 - 4 animals (2 released alive), 2 animals (released alive) .

[b] In 2006, 1 animal from Massachusetts was classified as having signs of fishery interaction. In 2008, 2 animals from Massachusetts and one from South Carolina were classified as human interactions. In 2009, the 4 animals that mass-stranded in September and were released alive, as well as a March stranding that a bystander had attempted to rescue were classified at human interactions. In 2010, 2 animals in Massachusetts were classified as human interactions, one of them a fishery interaction. In 2011, one animal was classified as human interaction due to post-mortem mutilation.

[c] Records of mass strandings in New York during this period are: September 2007 - 3 animals.

~~Table 3. White-sided dolphin (*Lagenorhynchus acutus*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2006-2010.~~

~~Area~~	-					~~**Total**~~
	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	
~~Maine~~	~~3~~	~~1~~	~~1~~	~~1~~	~~1~~	~~7~~
~~New Hampshire~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~
~~Massachusetts[a,b]~~	~~49~~	~~18~~	~~33~~	~~22~~	~~50~~	~~172~~
~~Rhode Island~~	~~4~~	~~0~~	~~0~~	~~1~~	~~0~~	~~5~~
~~Connecticut~~	~~0~~	~~0~~	~~1~~	~~1~~	~~0~~	~~2~~
~~New York[c]~~	~~3~~	~~5~~	~~1~~	~~3~~	~~1~~	~~13~~
~~New Jersey~~	~~1~~	~~0~~	~~0~~	~~2~~	~~0~~	~~3~~
~~Delaware~~	~~1~~	~~0~~	-	~~1~~	~~0~~	~~2~~
~~Maryland~~	~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~
~~Virginia~~	~~3~~	~~0~~	~~1~~	~~0~~	~~0~~	~~4~~
~~North Carolina~~	~~1~~	~~1~~	~~3~~	~~1~~	~~0~~	~~6~~
~~South Carolina[b]~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~
~~**TOTAL US**~~	~~**66**~~	~~**25**~~	~~**42**~~	~~**33**~~	~~**52**~~	~~**218**~~
~~Nova Scotia~~	~~1~~	~~9~~	~~3~~	~~4~~	~~2~~	~~19~~
~~Newfoundland and Labrador~~	~~3~~	~~1~~	~~2~~	~~3~~	~~2~~	~~11~~
~~GRAND TOTAL~~	~~**70**~~	~~**35**~~	~~**47**~~	~~**40**~~	~~**56**~~	~~**248**~~

~~[a] Records of mass strandings in Massachusetts during this period are: January 2006 – 4 separate events involving 23 white-sided dolphins (5 released alive); February 2006 – 2 events involving 1 and 5 animals; July 2006 - 9 animals (7 released alive); January 2007 - 9 animals (3 released alive); September 2007 - 3 animals; January 2008–17animals, February 2008 – 3 animals (2 released alive); September 2009 – 3 events of 2, 3 and 4 animals (all but 1 released alive); April 2009 – 3 animals (all released alive); March 2010 – 7 animals (one dead calf, 6 adults released alive), 16 animals (5 dead, 11 released alive) and 3 animals (one released alive); April 2010 – 2 animals (released alive); July 2010 – 2 animals (released alive).~~

[b] ~~In 2006, 1 animal from Massachusetts was classified as having signs of fishery interaction. In 2008, 2 animals from Massachusetts and one from South Carolina were classified as human interactions. In 2009, the 4 animals that mass-stranded in September and were released alive, as well as a March stranding that a bystander had attempted to rescue were classified at human interactions. In 2010, 2 animals in Massachusetts were classified as human interactions, one of them a fishery interaction.~~

STATUS OF STOCK

~~The species is~~ White-sided dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the Marine Mammal Proections Act.~~. This is not a strategic stock because t~~The ~~2006~~2007~~ 2010~~ 2011 estimated average annual human related mortality does not exceed~~s~~ PBR. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of white-sided dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. A trend analysis has not been conducted for this species. ~~The species is not listed as threatened or endangered under the Endangered Species Act.~~

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SHORT-BEAKED COMMON DOLPHIN (*Delphinus delphis delphis*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The common dolphin may be one of the most widely distributed species of cetaceans, as it is found world-wide in temperate and subtropical seas. In the North Atlantic, common dolphins occur over the continental shelf between~~along~~ the 100-2000-m isobaths and over prominent underwater topography and east to the mid-Atlantic Ridge (29˚W) (Doksaeter *et al.* 2008; Waring *et al*. 2008). The species is less common south of Cape Hatteras, although schools have been reported as far south as the Georgia/South Carolina border (32º N) (Jefferson *et al.* 2009). In waters off the northeastern USA coast, common dolphins are distributed along the continental shelf between the 100-2000-m isobaths~~slope~~ and are associated with Gulf Stream features (CETAP 1982; Selzer and Payne 1988; Waring *et al.* 1992; Hamazaki 2002). They occur from Cape Hatteras northeast to Georges Bank (35˚ to 42˚N) during mid-January to May (Hain *et al.* 1981; CETAP 1982; Payne *et al.* 1984). Common dolphins move onto Georges Bank, Gulf of Maine, and the Scotian Shelf from mid-summer to autumn. Selzer and Payne (1988) reported very large aggregations (greater than 3,000 animals) on Georges Bank in autumn. Common dolphins were~~are~~ occasionally found in the Gulf of Maine (Selzer and Payne 1988), more often in the last few years (Figure 1). Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs during summer and autumn when water temperatures exceed 11ºC (Sergeant *et al.* 1970; Gowans and Whitehead 1995).

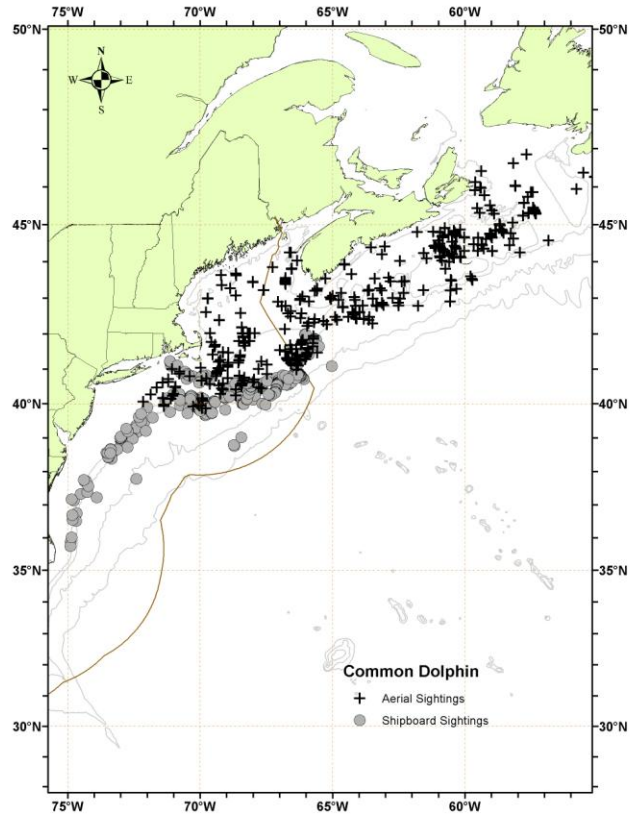

Figure 1. *Distribution of common dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, 2007, 2010 and 2011 and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Westgate (2005) tested the proposed one-population-stock model using a molecular analysis of mitochondrial DNA (mtDNA), as well as a morphometric analysis of cranial specimens. Both genetic analysis and skull morphometrics failed to provide evidence ($p>0.05$) of more than a single population in the western North Atlantic, supporting the proposed one-stock model. However, when western and eastern North Atlantic common dolphin mtDNA and skull morphology were compared, both the cranial and mtDNA results showed evidence of restricted gene flow ($p<0.05$) indicating that these two areas are not panmictic. Cranial specimens from the two sides of the North Atlantic differed primarily in elements associated with the rostrum. These results suggest that common dolphins in the western North Atlantic are composed of a single panmictic group whereas gene flow between the western and eastern North Atlantic is limited (Westgate 2005; 2007).

There is a peak in parturition during July and August with an average birth day of 28 July. Gestation lasts about 11.7 months and lactation lasts at least a year. Given these results western North Atlantic female common dolphins are likely on a 2-3 year calving interval. Females become sexually mature earlier (8.3 years and 200 cm) than males (9.5 years and 215 cm) as males continue to increase in size and mass. There is significant sexual dimorphism

present with males being on average about 9% larger in body length (Westgate 2005; Westgate and Read 2007).

POPULATION SIZE

Several abundance estimates are available for common dolphins from selected regions for selected time periods. The current best abundance estimate for common dolphins off the U.S. or Canadian Atlantic coast is the result of the 2011 survey – 67,191173,486 (CV=0.290.5529). This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July–August 2007 and is considered best because it covered more of the common dolphin range than the other surveys.

An abundance estimate of 90,547 (CV=0.244) common dolphins was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of trackline in waters north of Maryland (38ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent-team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).

An abundance estimate of 30,196 (CV=0.537) common dolphins was derived from a shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50 m) between Florida and Maryland (27.5 and 38º N latitude) conducted during June–August, 2004 (Table 1). The survey employed two independent visual teams searching with 25×x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001; Palka 2006).

An abundance estimate of 84,000 (CV=0.36) common dolphins was obtained from an aerial survey conducted in August 2006, which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An abundance estimate of 173,486 (CV=0.55) common dolphins was generated from the Canadian Trans-North Atlantic Sighting Survey TNASS in July–August 2007 (Lawson and Gosselin 2009). This aerial survey covered area waters from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (MRDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (20071997) analysis method (Lawson and Gosselin in 2011).

An abundance estimate of 67,191 (CV=0.29) common dolphins was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the estimate covered 5,313 km of tracklines that were over waters north of New Jersey and shallower thanfrom the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in water offshore ofbetween central North CarolinaVirginia to and Massachusetts (in waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two simultaneous teamdouble-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 2,993 (CV=0.87) common dolphins was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed a double-platformtwo independent visual team procedures searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program

Distance (version 6.0, release 2, Thomas *et al.* 2009).

Please see appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Table 1. Summary of abundance estimates for western North Atlantic short-beaked common dolphin. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Aug 2004~~	~~Maryland to Bay of Fundy~~	~~90,547~~	~~0.24~~
~~Jun-Aug 2004~~	~~Florida to Maryland~~	~~30,196~~	~~0.54~~
~~Jun-Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~120,743~~	~~0.23~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	84,000	0.36
July-Aug 2007	N. Labrador to Scotian Shelf	173,486	0.~~29~~55
Jul-Aug 2011	~~North Carolina~~Central Virginia to lower Bay of Fundy	67,191	0.29
Jun-Aug 2011	Central Florida to Central Virginia	2,993	0.87
Jun-Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	70,184	0.28

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for common dolphins is ~~67,191~~173,486 animals (CV=~~0.29~~0.55) derived from the ~~2011~~ 2007 TNASS survey~~s~~. The minimum population estimate for the western North Atlantic common dolphin is ~~52,893.~~ 112,531.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~A trend analysis has not been conducted for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 112,531~~52,893~~ animals. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor is 0.5, the default value for stocks of unknown status relative to optimum sustainable population

(OSP), and because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic stock of common dolphin is ~~529~~1,125.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during ~~2006~~2007–~~2010~~ 2011 was ~~164~~ 168 (CV=~~0.12~~0.12) common dolphins.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

For more details on the historical fishery interactions prior to 1999 see Waring *et al.* (2007).

In the Atlantic pelagic longline fishery between 1990 and 2007, 20 common dolphins were observed hooked and released alive.

——The estimated fishery-related mortality of common dolphins attributable to the *Loligo* squid portion of the Southern New England/mid-Atlantic Squid, Mackerel, Butterfish Trawl fisheries was 0 between 1997-1998 and 49 in 1999 (CV=0.97). After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl fishery.

In the Atlantic mackerel portion of the Southern New England/mid-Atlantic Squid, Mackerel, Butterfish Trawl fisheries, the estimated fishery-related mortality was 161 (CV=0.49) animals in 1997 and 0 in 1998 and 1999. However, the estimates in both the mackerel and *Loligo* fisheries should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl and mid-Atlantic mid-water trawl fisheries.

There was one observed take in the Southern New England/mid-Atlantic Bottom Trawl fishery reported in 1997. The estimated fishery-related mortality for common dolphins attributable to this fishery was 93 (CV=1.06) in 1997 and 0 in 1998 and 1999. After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl fishery.

Northeast Sink Gillnet

In 1990, an observer program was started by NMFS to investigate marine mammal takes in the Northeast sink gillnet fishery (Appendix III). Bycatch in the northern Gulf of Maine occurs primarily from June to September, while in the southern Gulf of Maine, bycatch occurs from January to May and September to December. Four common dolphins were observed taken in northeast sink gillnet fisheries in 2005, 1~~one~~ in 2006, 1~~one~~ in 2007, 2~~two~~ in 2008, 3 in 2009, ~~and~~ 4 in 2010 and 6 in 2011. The estimated annual fishery-related mortality and serious injury attributable to the northeast sink gillnet fishery (CV in parentheses) was 0 in 1995, 63 in 1996 (1.39), 0 in 1997, 0 in 1998, 146 in 1999 (0.97), 0 in 2000–2004, 5 (0.80) in 2005, 20 (1.05) in 2006, 11 (0.94) in 2007, 34 (0.77) in 2008, 43 (0.77) in 2009, ~~and~~ 42 (0.~~94~~88) in 2010 and 64 (0.73) -in 2011 (Table 2; Orphanides 2013). The ~~2006~~2007–~~2010~~ 2011 average annual mortality attributed to the northeast sink gillnet was ~~30~~ 39 animals (CV=~~0.42~~0.38).

A study of the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´N) in February~~, March and~~ April. Researchers purposely picked an area of historically high bycatch rates in order to have a chance of finding a significant difference. Eight research strings of fourteen nets each were fished and 159 hauls were completed during the course of the 2009-2010 study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. One common dolphin was caught in this study south of New England in 72

hauls during 2009 and ~~and~~ one animal was caught in 72 hauls during the 2010 experiment in the ~~Northeas~~mid-Atlantic~~t~~ (A.I.S., Inc. 2010). These 2 takes are included in the observed interactions and added to the total estimates in Table 2, though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Mid-Atlantic Gillnet

Two common dolphins were observed taken in 1995, 1996, and 1997, and no takes were observed from 1998 to 2005. One common dolphin was taken in an observed trip during 2006, none were observed in 2007–2009, ~~and~~ 10 ~~takes were observed~~ in 2010 and 3 in 2011. Using the observed takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 7.4 in 1995 (0.69), 43 in 1996 (0.79), 16 in 1997 (0.53), 0 in 1998-2005, 11 (1.03) in 2006, 0 in 2007~~–~~–2009, ~~and~~ 31 (0.65) in 2010 and 30 (0.52) in 2011. Average annual estimated fishery-related mortality attributable to this fishery during ~~2006~~2007~~–2010~~–2011 was ~~8.4~~12 (CV=~~0.55~~0.36) common dolphins (Table 2; Orphanides 2013). A study of the effects of tie-downs and bycatch rates of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in both control and experimental gillnet gear operating in Statistical Area 612 (off NY and NJ) between 14 November 2010 and 18 December 2010 had 100% observer coverage. This experimental fishery captured ~~7~~ 6 common dolphins and ~~two~~ 3 unidentified dolphins, (unidentified due to lack of photos) during this time period (Fox *et al.* 2011). These ~~7~~ 6 takes are included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in bycatch rate calculations that was expanded to the rest of the fishery~~in~~ (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. Revised serious injury guidelines were applied for the period 2007-2011 (Waring *et al.* in prep.). ~~One c~~Common dolphin mortalities (and serious injuries in parentheses) observed by both at-sea monitors and traditional fisheries observers in this fishery were ~~was observed taken in 2002, 3 in 2004, 5 in 2005, 1 in 2006, 3~~ 2 (0) in 2007, 1 (0) in 2008, 5 (0) in 2009, ~~and 9~~ 29 (2) in 2010, and 22 (0) in 2011 (Table 2). The estimated annual fishery-related mortality and serious injury attributable to the northeast bottom trawl fishery (CV in parentheses) was 27 in 2000 (0.29), 30 (0.30) in 2001, 26 (0.29) in 2002, 26 (0.29) in 2003, 26 (0.29) in 2004, 32 (0.28) in 2005, 25 in 2006, 24 (0.28) in 2007, 17 (0.29) in 2008, 19 (0.30) in 2009, and 17 (0.28) in 2010. No estimate was generated in 2011. The ~~2006~~2007–2010 average annual mortality attributed to the northeast bottom trawl was ~~20~~ 19 animals (CV=0.13).

Mid-Atlantic Bottom Trawl

Revised serious injury guidelines were applied for the period 2007–2011 (Waring *et al* in prep.). Common dolphin mortalities (and serious injuries in parentheses) observed in this fishery were~~Three common dolphins were observed taken in mid-Atlantic bottom trawl fisheries in 2000, 2 in 2001, 9 in 2004, 15 in 2005, 14 in 2006~~, 0 (0) in 2007, 1 (0) in 2008, 12 (0) in 2009, ~~and~~ 2 (0) in 2010, and 29 (1) in 2011 (Table 2). The estimated annual fishery-related mortality and serious injury attributable to the ~~M~~mid-Atlantic~~northeast~~ bottom trawl fishery (CV in parentheses) was 93 in 2000 (0.26), 103 (0.27) in 2001, 87 (0.27) in 2002, 99 (0.28) in 2003, 159 (0.30) in 2004, 141 (0.29) in 2005, 131 (0.28) in 2006, 66 (0.27) in 2007, 108 (0.28) in 2008, 104 (0.29) in 2009 and 104 (0.29) in 2010. No estimate was generated in 2011. The ~~2006~~2007–2010 average annual mortality attributed to the mid-Atlantic bottom trawl was ~~103~~ 96 animals (CV=~~0.13~~0.14).

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

A short-beaked common dolphin mortality was observed in this fishery only in 2010 (Table 2) so~~but~~ an expanded bycatch estimate has not been calculated since the observed takes are so rare.

Mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

The ~~first year a~~only short-beaked common dolphin mortality ~~had been~~ observed in this fishery was in 2007. This animal was taken in the same haul as an Atlantic white-sided dolphin. Due to small sample sizes, the bycatch rate model used the 2003 to September 2007 observed mid-water trawl data, including paired and single, and northeast and mid-Atlantic mid-water trawls (Palka, pers. comm.). The model that best fit these data was a Poisson logistic regression model that included latitude and bottom depth as significant explanatory variables, where soak duration was the unit of effort. The resultant estimated annual fishery-related mortality and serious injury (CV in parentheses) was 3.2 (0.70) for 2007. The ~~2006~~2007~~–2010~~–2011 average annual mortality attributed to the mid-

Atlantic mid-water trawl was 0.6 (0.70) animals.

Pelagic Longline

In 2009, a common dolphin mortality was observed in the pelagic longline fishery, mid-Atlantic Bight fishing area (Garrison and Stokes 2010). The expanded estimate (CV in parentheses) for common dolphin bycatch attributed to this fishery was 8.5 (1.0) for 2009. The ~~2006~~2007 ~~2010~~ 2011 average annual mortality was 1.7 (1.0).

Table 2. Summary of the incidental mortality of short-beaked common dolphins (*Delphinus delphis delphis*) by commercial fishery including the years sampled ~~(Years)~~, the type of data used ~~(Data Type)~~, the annual observer coverage ~~(Observer Coverage)~~, ~~the~~ the serious injuries and mortalities recorded by on-board observers ~~(Observed Serious Injury and Mortality)~~, the estimated annual serious injur~~ies~~y ~~(Estimated Serious Injury)~~ and mortality ~~(Estimated Mortality)~~, the combined serious injury and mortality estimate ~~(Estiamted Combined Mortality),~~ the estimated CV of the annual combined serious injury and mortality ~~(Estimated CVs)~~ and the mean annual serious injury and mortality estimate (~~Mean Annual Combined Mortality; the~~ CV in parentheses).

Fishery [a]	Years	Data Type [b]	Observer Coverage [c]	Observed Serious Injury [f]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Combined Mortality
Northeast Sink Gillnet [e]	~~06~~07-~~10~~11	Obs. Data, Trip Logbook, Allocated Dealer Data	~~.04,~~ .07, .05, .04, .17, .19	0, 0, 0, 0, 0	~~1,~~ 1, 2, 3, 4, 6	0, 0, 0, 0, 0	~~20,~~ 11, 34, 43, 42, 64	~~20,~~ 11, 34, 43, 42, 64	~~1.05,~~ .94, .77, .77, .~~94~~88, .73	39 (.38)
Mid-Atlantic Gillnet [e]	~~06~~ 07-~~10~~ 11	Obs. Data, Trip Logbook, Allocated Dealer Data	~~.03,~~ .04, .03, .03, .04, .02	0, 0, 0, 0, 0	~~1,~~ 0, 0, 0, 10, 3	0, 0, 0, 0, 0	~~11,~~ 0, 0, 0, ~~31~~30, 29	~~11,~~ 0, 0, 0, ~~31~~30, 29	~~1.03,~~ 0, 0, 0, .~~65~~48, .53	~~8.4~~12 (~~.55~~.36)
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	~~06~~07-~~10~~11	Obs. Data ~~Weighout~~ Trip Logbook	~~.089,~~ .039, .13, .13, .25, .41	0, 0, 0, 0, 0	~~0,~~ 1, 0, 0, 0, 0	0, 0, 0, 0, 0,	~~0,~~ 3.2, 0, 0, 0, 0	~~0,~~ 3.2, 0, 0, 0, 0	~~0,~~ .70, 0, 0, 0, 0, 0	0.6 (.70)
Northeast Mid-water Trawl - Including Pair Trawl	~~06~~07-~~10~~11	Obs. Data ~~Weighout~~ Trip Logbook	~~.031,~~ .08, .199, .42, .54, .41	0, 0, 0, 0, 0	~~0,~~ 0, 0, 0, 1, 0	0, 0, 0, 0, 0	~~0,~~ 0, 0, 0, na, 0	~~0,~~ 0, 0, 0, na, 0	~~0,~~ 0, 0, 0, na, 0	na
Northeast Bottom Trawl [d]	~~06~~07-~~10~~11	Obs. Data ~~Dealer Data~~ Trip Logbook ~~VTR Data~~	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 2, 0	2,1,5,29, 22	~~0,~~ 0, 0, 0, ~~0~~ na, 0	~~25,~~ 24, 17, 19, 17, na	~~25,~~ 24, 17, 19, 17, na	~~.28,~~ .28, .29, .30, .28, na	~~20~~ 19 (.13)

Mid-Atlantic Bottom Trawl [d]	~~06~~07-~~10~~11	Obs. Data Trip Logbook ~~Dealer~~	~~.02,~~ .03, .03. .05, .06, .08	0, 0, 0, 0 , ~~0~~1	~~14,~~ 0, 1, 12, 2, 29	~~0,~~ 0, 0, 0, 0, na	~~131,~~ 66, 108, 104, 104, na	~~131,~~ 66, 108, 104, 104, na	~~.28,~~ .27, .28, .29, .29, na	~~103~~ 96 (~~.13~~.14)
Pelagic Longline [b]	~~06~~07-~~10~~11	Obs. Data Logbook	~~.07,~~ .07, .07, .10, .08, .09	0, 0, 0, 0, 0	~~0,~~ 0, 0, 1, 0, 0	0, 0, 0, 0, 0	~~0,~~ 0, 0, 8.5, 0, 0	~~0,~~ 0, 0, 8.5, 0, 0	~~0,~~ 0, 0, 1.0, 0, 0	1.7 (1.0)
TOTAL										~~164~~ 168 (~~.12~~.12)

a. The fisheries listed in Table 2 reflect new definitions defined by the proposed List of Fisheries for 2005 (FR Vol. 69, No. 231, 2004). The 'North Atlantic bottom trawl' fishery is now referred to as the 'Northeast bottom trawl.' The Illex, Loligo and Mackerel fisheries are now part of the 'mid-Atlantic bottom trawl' and 'mid-Atlantic midwater trawl' fisheries.

b. Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (unallocated Dealer ~~Dreported d~~ata or Allocated Dealer Data) which are used as a measure of total landings and mandatory Vessel Trip Reports (VTR) (Trip Logbook) ~~that~~ are used to determine the spatial distribution of landings and fishing effort.

c. The observer coverages for the Northeast sink gillnet fishery are ratios based on tons of fish landed. N~~orth~~ortheast~~orth Atlantic~~ bottom trawl, mid-Atlantic bottom trawl, Northeast mid-water and~~and~~ ~~mm~~id-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes only samples collected from traditional fisheries observer, but not the fishery monitors. ~~In the Northeast region 437 and 658 bottom trawl trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 bottom trawl trips were sampled by observers and monitors, respectively.~~ Monitor trips ~~will be~~were incorporated ~~next year,~~ for 2011, the first full year of monitor coverage.

d. N~~orth~~ortheast~~E~~ and mid-Atlantic~~MA~~ bottom trawl mortality estimates reported for 2007–2010 ~~are~~ included serious injuries and were a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005; Rossman 2010) and the respective annual fishing effort (2007-2010). Because of this pooling, years with no observed mortality may still have a calculated estimate. ~~The methods used in Rossman 2010 are scheduled to be updated during 2012-2013 to reflect data collected during the latest five year (2006-2010) period.~~ 2010 estimates include only takes observed by traditional fishery observers. ~~Observed takes do not include those observed by fishery 'monitors' and so are not incorporated into 2010 bycatch estimation.~~2011 estimates were not calculated and the mean annual mortality values are averages of 2007–2010 only.

e. One common dolphin was incidentally caught in 2009 ~~and one in 2010~~ in the northeast gillnet fishery and one in 2010 in the mid-Atlantic gillnet fishery as part of a NEFSC hanging ratio study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. ~~Seven~~ Six common dolphins were caught in a study of the effects of tie-downs on Atlantic Sturgeon bycatch rates conducted in the mid-Atlantic gillnet fishery in 2010. ~~another research study in 2010.~~ ~~These animals~~All research takes are included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in bycatch rate calculations that was expanded to the rest of the fishery.

f. Serious injuries were evaluated for the 2007–2011 period using new guidelines and include both at-sea monitor and traditional observer data (Waring *et al.* in prep.)

CANADA

Between January 1993 and December 1994, 36 Spanish deep water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Banks) (Lens 1997). A total of 47 incidental catches were recorded, which included one common dolphin. The incidental mortality rate for common dolphins was 0.007/set.

Other Mortality

Two common dolphins were reported as incidental mortalities in NEFSC Atlantic herring monitoring activities in 2004. In 2007, one common dolphin was reported taken in a NEFSC spring bottom trawl survey.

From ~~2006~~ 2007 to ~~2010~~2011, ~~469~~ 484 common dolphins were reported stranded between Maine and Florida (Table 3). The total includes mass stranded common dolphins in Massachusetts during ~~2006 (a total of 65 in 10 events),~~ 2007 (a total of 23 in 5 separate events), 2008 (one event of 5 animals and one of 2 animals), 2009 (a total of 26 in 6 events), ~~and~~ 2010 (a total of 30 in 8 events), and 2011 (a total of 30 animals in 5 events) and one mass stranding in North Carolina in 2011 (4 animals). ~~Eighteen animals in 2006, 2~~Two animals in 2007, 2 animals in 2008, 5 animals in 2009, ~~and~~ 11 animals in 2010, and 15 animals in 2011 were released or last sighted alive. Human interactions were indicated on one of the 2007 New York mortality records and one of the 2006 Virginia mortality

records. –In 2008, seven common dolphins had indications of human interactions, four which were fishery interactions. –In 2009, six common dolphins had indications of human interaction, 3 of which were classified as fishery interactions. In 2010, 7 animals were classified as human interactions, ~~3~~ 2 of which were fishery interactions (all Massachusetts mass-stranded animals) and 2 of which (Rhode Island) involved animals last sighted free-swimming. In 2011, 3 animals were classified as having human interactions, 2 of which were fishery interactions (one of these was satellite-tagged and released). An Unusual Mortality Event (UME) was declared in 2008 due to a relatively high number of strandings between January and April 2008, from New Jersey to North Carolina. Twenty seven common dolphins were involved in this event (http://www.nmfs.noaa.gov/pr/health/mmume/midatlantic2008.htm accessed 19 April 2011). In Bogomolni's 2010 analysis of mortality causes of stranded marine mammals on Cape Cod and southeastern Massachusetts between 2000 and 2006, 61% of stranded common dolphins were involved in mass-stranding events, and 37% of all the common dolphin stranding mortalities were disease related (Bogomolni 2010).

Four common dolphin strandings (6 individuals) were reported on Sable Island, Nova Scotia from 1996 to 1998 (Lucas and Hooker 1997; 2000). The Marine Animal Response Society of Nova Scotia reported one common dolphin stranded in 2008, one in 2009 ~~and~~ , one (released alive) in 2010, and 2 (one a fisheries interaction) in 2011 (Tonya Wimmer, pers. comm.).

Table 3. Short-beaked common dolphin (*Delphinus delphis delphis*) reported strandings along the U.S. Atlantic coast, 2007-2011.

STATE	2007	2008	2009	2010	2011	TOTALS
Maine	1	0	0	1	0	2
Massachusetts[a]	65	19	53	71	64	272
Rhode Island[c]	4	3	6	7	5	25
New York [b, c]	23	2	7	9	17	58
New Jersey[c]	0	0	0	1	0	1
Connecticut	4	9	6	14	9	42
Delaware[c]	0	2	4	0	1	7
Maryland	0	2	2	0	1	5
Virginia[c]	4	20	2	5	9	40
North Carolina[a, c]	0	1	7	6	18	32
TOTALS	101	58	87	114	124	484

a. Massachusetts mass strandings (2007 - 9,2,4,6,2; 2008 - 5,2; 2009 - 2,3,3,4,6,8, 2010 - 2,2,3,3,3,4,5,8; 2011-3,3,4,7,13). North Carolina mass stranding of 4 animals in 2011.

b. Twenty (12 dead, 8 rescued; one of the mortalities classified as human interaction) animals involved in a mass stranding in Suffolk county in 2007. Seven animals involved in 2 mass stranding events in March 2009 (six euthanized, 1 died at site, 2 had signs of fishery interaction). In addition, in 2008 3 animals were relocated from the Nansemond River.

c. One 2006 mortality in Virginia and one 2007 mortality in New York reported as having human interactions. Seven records with signs of human interaction in 2008 - 3 from Virginia, 1 -from Massachusetts, one from North Carolina, and one from Delaware. Of these, 4 were fishery interactions. Six human interaction cases in 2009 (2 Massachusetts, 3 Rhode Island, 1 New York), 3 of which were classified as fishery interactions (2 in Rhode Island and 1~~one~~ in Massachusetts). Seven HI cases in 2010 (4 mortalities in MA, 2 released alive in RI, and 1 mortality in New Jersey), 2 of which (Massachusetts) were classified as fishery interactions. Three HI cases in 2011, all in Massachusetts, 2 of which were classified as fishery interactions (but one of those fishery interaction animals was released alive).

~~Table 3. Short-beaked common dolphin (*Delphinus delphis delphis*) reported strandings along the U.S. Atlantic coast, 2006-2010.~~

~~STATE~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~TOTALS~~
~~Maine~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~2~~
~~Massachusetts[a]~~	~~100~~	~~65~~	~~19~~	~~53~~	~~71~~	~~308~~
~~Rhode Island[c]~~	~~2~~	~~4~~	~~3~~	~~6~~	~~7~~	~~22~~
~~New York[b, c]~~	~~3~~	~~23~~	~~2~~	~~7~~	~~9~~	~~44~~
~~New Jersey[c]~~	~~2~~	~~4~~	~~9~~	~~6~~	~~14~~	~~35~~
~~Delaware[c]~~	~~0~~	~~0~~	~~2~~	~~4~~	~~0~~	~~6~~
~~Maryland~~	~~0~~	~~0~~	~~2~~	~~2~~	~~0~~	~~4~~
~~Virginia[c]~~	~~1~~	~~4~~	~~20~~	~~2~~	~~5~~	~~32~~
~~North Carolina[c]~~	~~2~~	~~0~~	~~1~~	~~7~~	~~6~~	~~16~~
~~TOTALS~~	~~110~~	~~101~~	~~58~~	~~87~~	~~113~~	~~469~~

~~a. Massachusetts mass strandings (2006 - 2,2,3,4,4,3,9,10,14, and 14; 2007 - 9,2,4,6,2; 2008 - 5 and 2; 2009 - 2,3,3,4,6,8, 2010 - 2,2,3,3,3,4,5,8).~~

~~b. One common dolphin was released alive from a pound net in 2006 in New York. Twenty (12 dead, 8 rescued; one of the mortalities classified as human interaction) animals were involved in a mass stranding in Suffolk county in 2007. Seven animals were involved in 2 mass stranding events in March 2009 (six euthanized, 1 died at site, 2 had signs of fishery interation). In addition, in 2008 3 animals were relocated from the Nansemond River.~~

~~c. One 2006 mortality in Virginia and one 2007 mortality in New York were reported as having human interactions. Seven records were reported with signs of human interaction in 2008 - 3 from Virginia, 1 from Massachusetts, one from North Carolina, and one from Delaware. Of these, 4 were fishery interactions. Six human interaction cases were reported in 2009 (2 Massachusetts, 3 Rhode Island, 1 New York), 3 of which were classified as fishery interactions (2 in Rhode Island and one in Massachusetts). Seven HI cases were reported in 2010 (4 mortalities in MA, 2 released alive in RI, and 1 mortality in NJ), 2 of which (MA) were classified as fishery interactions.~~

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

STATUS OF STOCK

Short-beaked common dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act.The ~~2006~~2007 ~~2010~~ 2011 average annual human-related mortality does not exceed PBR~~; therefore, this is not a strategic stock~~. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of short-beaked common dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated~~There are insufficient data to determine the population trends for this species~~. ~~The species is not listed as threatened or endangered under the Endangered Species Act.~~

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STRIPED DOLPHIN (*Stenella coeruleoalba*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The striped dolphin, *Stenella coeruleoalba*, is distributed worldwide in warm-temperate to tropical seas (Archer and Perrin 1997; Archer 2002). Striped dolphins are found in the western North Atlantic from Nova Scotia south to at least Jamaica and in the Gulf of Mexico. In general, striped dolphins appear to prefer continental slope waters offshore to the Gulf Stream (Leatherwood *et al.* 1976; Perrin *et al.* 1994; Schmidly 1981). There is very little information concerning striped dolphin stock structure in the western North Atlantic (Archer and Perrin 1997).

In waters off the northeastern U.S. coast, striped dolphins are distributed along the continental shelf edge from Cape Hatteras to the southern margin of Georges Bank, and also occur offshore over the continental slope and rise in the mid-Atlantic region (CETAP 1982; Mullin and Fulling 2003). Continental shelf edge sightings in this program were generally centered along the 1,000 m depth contour in all seasons (CETAP 1982). During 1990 and 1991 cetacean habitat-use surveys, striped dolphins were associated with the Gulf Stream north wall and warm-core ring features (Waring *et al.* 1992). Striped dolphins seen in a survey of the New England Sea Mounts (Palka 1997) were in waters that were between 20˚and 27˚C and deeper than 900 m.

Although striped dolphins are considered to be uncommon in Canadian Atlantic waters (Baird *et al.* 1997), summer sightings (2-125 individuals) in the deeper and warmer waters of the Gully (submarine canyon off eastern Nova Scotia shelf) suggest that this region may be an important part of their range (Gowans and Whitehead 1995; Baird *et al.* 1997).

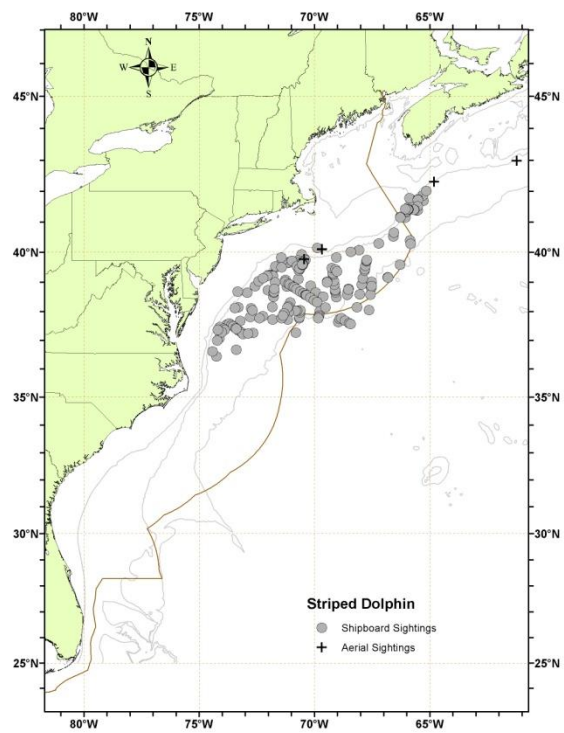

Figure 2: *Distribution of striped dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, 2007, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

POPULATION SIZE

~~Total numbers of striped dolphins off the U.S. or Canadian Atlantic coast are unknown, although s~~Several abundance estimates from selected regions are available for striped dolphins for select time periods. Sightings are almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 1). The best abundance estimate for striped dolphins is the ~~result~~ sum of the 2011 survey estimates ~~46,882~~54,807 (CV=0.3~~3~~).

Earlier abundance estimates

An abundance estimate of 36,780 striped dolphins (CV=0.27) was obtained from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). Abundance estimates of 25,939 (CV=0.36) and 13,157 (CV=0.45) striped dolphins were obtained from line-transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11 aircraft (NMFS 1991). An abundance estimate of 31,669 (CV=0.73) striped dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence. An abundance estimate of 49,945 (CV=0.40) striped dolphins was obtained from the sum of the estimate of 39,720 (CV=0.45) striped dolphins from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38ºN) (Palka 2006), and the estimate of 10,225 (CV=0.91) striped dolphins, estimated from a shipboard

line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38ºN) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, and should not be used for PBR determinations. Further, ~~due to changes in survey methodology these data should not be used to make comparisons to more current estimates~~Due to changes in survey methodology these historical data should not be used to make comparisons to more current estimates

Recent surveys and abundance estimates

~~An abundance estimate of 52,055 (CV=0.57) striped dolphins was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of trackline in waters north of Maryland (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38ºN) was conducted during June~~–~~–August~~,~~ 2004. The survey employed two independent visual teams searching with 25×~~x~~ bigeye ~~binocluars~~binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream Front in the mid-Atlantic. The survey included 5,659 km of trackline, and there were a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group-size bias and analyzed using line-transect distance analysis (Palka 1995, 2006; Buckland *et al.* 2001). The resulting abundance estimate for striped dolphins between Florida and Maryland was 42,407 animals (CV=0.53).

An abundance estimate of 46,882 (CV=0.33) striped dolphins was generated from a shipboard and aerial survey conducted during June~~–~~–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey ~~and shallower than~~from the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of ~~North Carolina~~Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a~~ two simultaneous team~~double platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).~~ Striped dolphins were also seen during the SEFSC summer 2011 abundance survey, which covered waters from North Carolina to Florida. The abundance resulting from the SEFSC survey has currently not yet been estimated.~~

~~t the same time another~~

An abundance estimate of 7,925 (CV=0.66) striped dolphins was generated from a shipboard survey conducted concurrently (June–August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25× bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

~~x~~

Table 1. Summary of abundance estimates for western North Atlantic striped dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV

~~Jun–Aug 2004~~	~~Maryland to the Bay of Fundy~~	~~52,055~~	~~0.57~~
~~Jun–Aug 2004~~	~~Florida to Maryland~~	~~42,407~~	~~0.53~~
~~Jun–Aug 2004~~	~~Florida to Bay of Fundy (COMBINED)~~	~~94,462~~	~~0.40~~
Jun~~–~~–Aug 2011	~~North Carolina~~ Central Virginia to lower Bay of Fundy	46,882	0.33
Jun–Aug 2011	Central Florida to Central Virginia	7,925	0.66
Jun–Aug 2011	Central Florida to lower Bay of Fundy (COMBINED)	54,807	0.3

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for striped dolphins is ~~46,882~~54,807 (CV=0.3~~3~~) obtained from the 2011 surveys. The minimum population estimate for the western North Atlantic striped dolphin is ~~35,763~~42,804.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~There are insufficient data to determine p~~~~Population trends for this species~~ ~~are currently being investigated and will be reported when completed.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~38,373~~42,804. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is 0.5 because this stock is of unknown status. PBR for the western North Atlantic striped dolphin is ~~358~~428.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality to this stock during ~~2006~~2007-~~2010~~ 2011 was zero striped dolphins.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year

period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

~~The pelagic drift gillnet fishery is now closed.~~ Forty striped dolphin mortalities were observed between 1989 and 1998 and occurred east of Cape Hatteras in January and February, and along the southern margin of Georges Bank in summer and autumn (Northridge 1996) attributed to the pelagic drift gillnet fishery, which is now closed. Estimated annual mortality and serious injury (CV in parentheses) attributable to the pelagic drift gillnet fishery were 39 striped dolphins in 1989 (0.31), 57 in 1990 (0.33), 11 in 1991 (0.28), 7.7 in 1992 (0.31), 21 in 1993 (0.11), 13 in 1994 (0.06), 2 in 1995 (0), 7 in 1996 (CV=0.22), no fishery in 1997 and 4 in 1998 (CV=0).

In the North Atlantic bottom trawl fishery the only reported fishery-related mortalities (two) occurred in 1991, where the total estimated mortality and serious injury attributable to this fishery for 1991 was 181 (CV=0.97).

USA

Bycatch has previously been observed by NMFS Fisheries Observer Program in the pelagic drift gillnet and North Atlantic bottom trawl fisheries (see above) but no mortalities or serious injuries have recently been documented in any U.S. fishery.

CANADA

No mortalities were documented in review of Canadian gillnet and trap fisheries (Read 1994). However, in a review of striped dolphins in Atlantic Canada two records of incidental mortality ~~have been~~were reported (Baird *et al.* 1997). In the late 1960s and early 1970s two mortalities each were reported in trawl and salmon net fisheries.

Between January 1993 and December 1994, 36 Spanish deep-water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211sets), were observed in NAFO Fishing Area 3 (off the Grand Bank) (Lens 1997). A total of 47 incidental catches were recorded, which included two striped dolphins. The incidental mortality rate for striped dolphins was 0.014 animals/set.

Other Mortality

A total of 68 striped dolphins ~~have been~~were reported stranded along the U.S. Atlantic coast between 1995 and 2005 (NMFS unpublished data). This includes one record of a mass stranding of 12 animals in North Carolina in 2005. During the period ~~2006~~2007-~~2010~~2011, a total of ~~47~~ 43 striped dolphins were reported stranded along the U.S. Atlantic coast (Table 2).

In eastern Canada, 10 strandings were reported off eastern Canada from 1926-1971, and 19 from 1991-1996 (Sergeant *et al.* 1970; Baird *et al.* 1997; Lucas and Hooker 1997). In both time periods, most of the strandings were on Sable Island, Nova Scotia. Two stranding mortalities were reported in Nova Scotia in 2004 and two in 2005.

Table 3~~:~~. Striped dolphin reported strandings along the U.S. Atlantic coast 2007-2011.

Stranding State	2007[a]	2008[b]	2009	2010	2011[c]	Total
Maine	1	0	0	0	0	1
Massachusetts	5	2	2	4	0	13
Rhode Island	0	1	0	1	0	2
New York	2	0	1	1	0	4
New Jersey	2	7	0	2	0	11
Delaware	1	0	0	0	0	1
Maryland	1	0	0	0	0	1
North Carolina	3	2	2	1	0	8
South Carolina	0	0	0	1	0	1
Puerto Rico	1	0	0	0	0	1

TOTALS	16	12	5	10	0	43

a. In 2007 one live stranding in Massachusetts was classified as a human interaction due to being pushed off the beach.

b. In 2008 one animal in New Jersey and one in North Carolina were classified as fishery interaction mortalities.

c. In 2011 one animal in Massachusetts and one in Rhode Island were classified as human interactions. Both animals had ingested plastic and a beachgoer had attempted to push out the Massachusetts animal.

STATUS OF STOCK

~~The species is~~Striped dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. Average annual human-related mortality and serious injury does not exceed the PBR~~; therefore, this is not a strategic stock~~. The total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR, therefore can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of striped dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this species. ~~The species is not listed as threatened or endangered under the Endangered Species Act.~~

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HARBOR PORPOISE (*Phocoena phocoena phocoena*): Gulf of Maine/Bay of Fundy Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

This stock is found in U.S. and Canadian Atlantic waters. The distribution of harbor porpoises has been documented by sighting surveys, strandings and takes reported by NMFS observers in the Sea Sampling Programs. During summer (July to September), harbor porpoises are concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 m deep (Gaskin 1977; Kraus *et al.* 1983; Palka 1995a; Palka 1995b), with a few sightings in the upper Bay of Fundy and on Georges Bank (Palka 2000). During fall (October-December) and spring (April-June), harbor porpoises are widely dispersed from New Jersey to Maine, with lower densities farther north and south. They are seen from the coastline to deep waters (>1800 m; Westgate *et al.* 1998), although the majority of the population is found over the continental shelf. During winter (January to March), intermediate densities of harbor porpoises can be found in waters off New Jersey to North Carolina, and lower densities are found in waters off New York to New Brunswick, Canada. There does not appear to be a temporally coordinated migration or a specific migratory route to and from the Bay of Fundy region. However, during the fall, several satellite tagged harbor porpoises did favor the waters around the 92-m isobath, which is consistent with observations of high rates of incidental catches in this depth range (Read and Westgate 1997). There were two stranding records from Florida during the 1980s (Smithsonian strandings database) and one in 2003 (NE Regional Office/NMFS strandings and entanglement database).

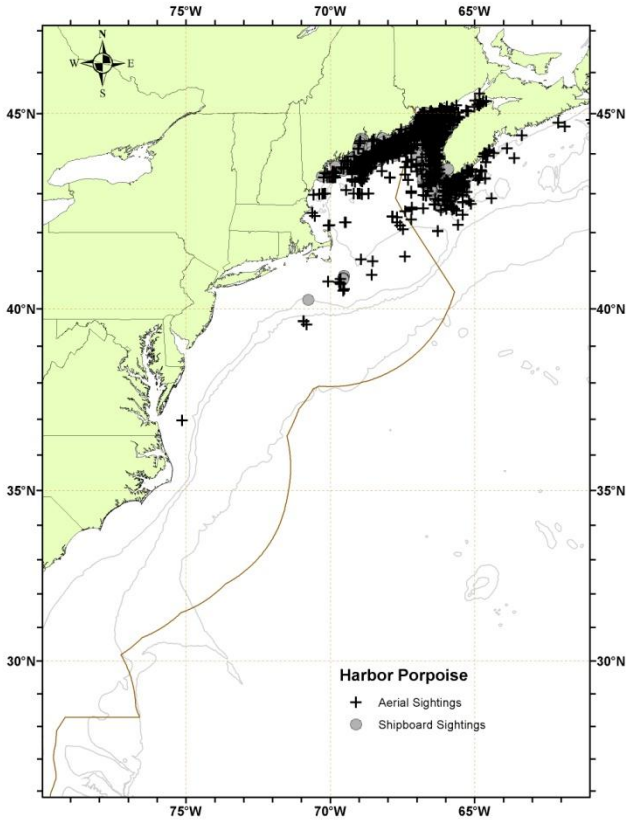

Figure 1. *Distribution of harbor porpoises from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011 and DFO's 2007 TNASS survey. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

Gaskin (1984, 1992) proposed that there were four separate populations in the western North Atlantic: the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland populations. Analyses involving mtDNA (Wang *et al.* 1996; Rosel *et al.* 1999a; 1999b), organochlorine contaminants (Westgate *et al.* 1997; Westgate and Tolley 1999), heavy metals (Johnston 1995), and life history parameters (Read and Hohn 1995) support Gaskin's proposal. Genetic studies using mitochondrial DNA (Rosel *et al.* 1999a) and contaminant studies using total PCBs (Westgate and Tolley 1999) indicate that the Gulf of Maine/Bay of Fundy females were distinct from females from the other populations in the Northwest Atlantic. Gulf of Maine/Bay of Fundy males were distinct from Newfoundland and Greenland males, but not from Gulf of St. Lawrence males according to studies comparing mtDNA (Palka *et al.* 1996; Rosel *et al.* 1999a) and CHLORs, DDTs, PCBs and CHBs (Westgate and Tolley 1999). Nuclear microsatellite markers have also been applied to samples from these four populations, but this analysis

failed to detect significant population sub-division in either sex (Rosel *et al.* 1999a). These patterns may be indicative of female philopatry coupled with dispersal of males. Both mitochondrial DNA and microsatellite analyses indicate that the Gulf of Maine/Bay of Fundy stock is not the sole contributor to the aggregation of porpoises found off the mid-Atlantic states during winter (Rosel *et al.* 1999a; Hiltunen 2006). Mixed-stock analyses using twelve microsatellite loci in both Bayesian and likelihood frameworks indicate that the Gulf of Maine/Bay of Fundy is the largest contributor (~60%), followed by Newfoundland (~25%) and then the Gulf of St. Lawrence (~12%), with Greenland making a small contribution (<3%). For Greenland, the lower confidence interval of the likelihood analysis includes zero. For the Bayesian analysis, the lower 2.5% posterior quantiles include zero for both Greenland and the Gulf of St. Lawrence. Intervals that reach zero provide the possibility that these populations contribute no animals to the mid-Atlantic aggregation. This report follows Gaskin's hypothesis on harbor porpoise stock structure in the western North Atlantic, where the Gulf of Maine and Bay of Fundy harbor porpoises are recognized as a single management stock separate from harbor porpoise populations in the Gulf of St. Lawrence, Newfoundland, and Greenland.

POPULATION SIZE

To estimate the population size of harbor porpoises in the Gulf of Maine/Bay of Fundy region, line-transect sighting surveys were conducted during the summers of 1991, 1992, 1995, 1999, 2002, 2004, 2006, 2007, and 2011. The best current abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is the result of the 2011 survey—: 79,883 (CV=0.32).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

An abundance estimate of 51,520 (CV=0.65) harbor porpoises was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 6,180 km of trackline from the 100-m depth contour on the southern Georges Bank to the lower Bay of Fundy. The Scotian shelf south of Nova Scotia was not surveyed (Table 1). Shipboard data were collected using the double-platform two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995b) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).

An abundance estimate of 89,054 (CV=0.47) harbor porpoises was generated from an aerial survey conducted in August 2006 using the same methods as the 2004 aerial survey. This which survey covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; NMFS 2006).

An abundance estimate of 12,732 (CV=0.61) harbor porpoises on the Scotian Shelf and in the Gulf of St. Lawrence was generated from the Canadian Trans North Atlantic Sighting Survey in July–August 2007 (and see Lawson and Gosselin 2009). The total estimate of 16,058 (CV=0.50) harbor porpoises from the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, and Newfoundland stocks was 16,058 (CV=0.50). generated from the Canadian Trans North Atlantic Sighting Survey in July–August 2007 (and see Lawson and Gosselin 2009). This aerial survey covered area waters from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general, this involved correcting for perception bias using mark-recapture distance sampling (MCDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (2007 1997) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 79,883 (CV=0.32) harbor porpoises was generated from a shipboard and aerial survey conducted during June–August 2011 (Palka 2012). The aerial portion that contributed to the abundance estimate covered 5,313 km of tracklines that were over waters north of New Jersey and shallower thanfrom the coastline to the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,107 km of tracklines that were in waters offshore of North Carolinacentral Virginia to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneousdouble-platform team data collection procedure, which

allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

No harbor porpoises were detected in a~~A~~n abundance survey that was conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed the double-platform methodology ~~two independent visual teams~~ searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. ~~conducted concurrently in the southern U.S. waters (from VirginiaNorth Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~

Table 1. Summary of recent abundance estimates for the Gulf of Maine/Bay of Fundy harbor porpoise (*Phocoena phocoena phocoena*). Month, year, and area covered during each abundance survey and the resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Jul 2004~~	~~Gulf of Maine to lower Bay of Fundy~~	~~51,520~~	~~0.65~~
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	89,054	0.47
Jul-Aug 2007[a]	Scotian Shelf and Gulf of St. Lawrence	12,732	0.61
Jul-Aug 2011	~~North Carolina~~Central Virginia to lower Bay of Fundy	79,883	0.32

a. A portion of this survey covered habitat of the Gulf of Maine/Bay of Fundy stock. The estimate also includes animals from the Gulf of St. Lawrence and Newfoundland stocks.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for harbor porpoises is 79,883 (CV=0.32). The minimum population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 61,415.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~Population trends for this species are currently being investigated and will be reported when completedA trend analysis has not been conducted for this species.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Several attempts have been made to estimate potential population growth rates. Barlow and Boveng (1991), who used a re-scaled human life table, estimated the upper bound of the annual potential growth rate to be 9.4%. Woodley and Read (1991) used a re-scaled Himalayan tahr life table to estimate a likely annual growth rate of 4%. In an attempt to estimate a potential population growth rate that incorporates many of the uncertainties in survivorship and reproduction, Caswell *et al.* (1998) used a Monte Carlo method to calculate a probability distribution of growth rates. The median potential annual rate of increase was approximately 10%, with a 90% confidence interval of 3-15%. This analysis underscored the considerable uncertainty that exists regarding the

potential rate of increase in this population. Moore and Read (2008) conducted a Bayesian population modeling analysis to estimate the potential population growth of harbor porpoise in the absence of bycatch mortality. Their method used fertility data, in combination with age-at-death data from stranded animals and animals taken in gillnets, and was applied under two scenarios to correct for possible data bias associated with observed bycatch of calves. Demographic parameter estimates were 'model averaged' across these scenarios. The Bayesian posterior median estimate for potential natural growth rate was 0.046. This last, most recent, value will be the one used for the purpose of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 61,415. The maximum productivity rate is 0.046. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the Gulf of Maine/Bay of Fundy harbor porpoise is 706.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Data to estimate the mortality and serious injury of harbor porpoise come from U.S. and Canadian Sea Sampling Programs, from records of strandings in U.S. and Canadian waters, and from records in the Marine Mammal Authorization Program (MMAP). See Appendix III for details on U.S. fisheries and data sources. Estimates using Sea Sampling Program and MMAP data are discussed by fishery under the Fishery Information section (Table 2). Strandings records are discussed ~~under the Unknown Fishery in the Fishery Information section (Table 3) and~~ under the Other Mortality section (Table 3).

The total annual estimated average human-caused mortality is 719~~835~~ harbor porpoises per year. This is derived from two components: 675~~791~~ harbor porpoise per year (CV=0.16) from U.S. fisheries using observer and MMAP data, and 44 per year (unknown CV) from Canadian fisheries using observer data.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). ~~-~~NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". ~~–~~Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Recently, Gulf of Maine/Bay of Fundy harbor porpoise takes have been documented in the U.S. Northeast sink gillnet, mid-Atlantic gillnet, and Northeast bottom trawl fisheries and in the Canadian herring weir fisheries (Table 2). Detailed U.S. fishery information is reported in Appendix III.

Earlier Interactions

One harbor porpoise was observed taken in the Atlantic pelagic drift gillnet fishery during 1991-1998; the fishery ended in 1998. This observed bycatch was notable because it occurred in continental shelf edge waters adjacent to Cape Hatteras (Read *et al.* 1996). Estimated annual fishery-related mortality (CV in parentheses) attributable to this fishery was 0.7 in 1989 (7.00), 1.7 in 1990 (2.65), 0.7 in 1991 (1.00), 0.4 in 1992 (1.00), 1.5 in 1993 (0.34), 0 during 1994-1996 and 0 in 1998. The fishery was closed during 1997. Information on Canadian fisheries that interact with stocks other than the Gulf of Maine/Bay of Fundy stock, can be found in Hooker (1997), Lesage *et al*. (2006) and Benjanims *et al*. (2007).

U.S.

Northeast Sink Gillnet

In 1990, an observer program was started by NMFS to investigate marine mammal takes in the Northeast sink gillnet fishery (Appendix III). Bycatch in the northern Gulf of Maine occurs primarily from June to September,

while in the southern Gulf of Maine, bycatch occurs from January to May and September to December. Estimated annual bycatch (CV in parentheses) from this fishery was 2,900 in 1990 (0.32), 2,000 in 1991 (0.35), 1,200 in 1992 (0.21), 1,400 in 1993 (0.18) (CUD 1994; Bravington and Bisack 1996), 2,100 in 1994 (0.18), 1,400 in 1995 (0.27) (Bisack 1997), 1,200 in 1996 (0.25), 782 in 1997 (0.22), 332 in 1998 (0.46), 270 in 1999 (0.28) (Rossman and Merrick 1999), 507 in 2000 (0.37), 53 (0.97) in 2001, 444 (0.37) in 2002, 592 (0.33) in 2003, 654 (0.36) in 2004, 630 (0.23) in 2005, 514 (0.31) in 2006, 395 (0.37) in 2007, 666 (0.48) in 2008, 591 (0.23) in 2009, ~~and~~ 387 (0.~~30~~27) in 2010, and 324 (0.20) in 2011 (Table 2; Orphanides 2013). There appeared to be no evidence of differential mortality in U.S. or Canadian gillnet fisheries by age or sex in animals collected before 1994, although there was substantial inter-annual variation in the age and sex composition of the bycatch (Read and Hohn 1995). Using observer data collected during 1990-1998 and a logit regression model, females were 11 times more likely to be caught in the offshore southern Gulf of Maine region, males were more likely to be caught in the south Cape Cod region, and the overall proportion of males and females caught in a gillnet and brought back to land were not significantly different from 1:1 (Lamb 2000).

Scientific experiments that demonstrated the effectiveness of pingers in the Gulf of Maine were conducted during 1992 and 1993 (Kraus *et al.* 1997). After the scientific experiments, experimental fisheries were allowed in the general fishery during 1994 to 1997 in various parts of the Gulf of Maine and south of Cape Cod areas. During these experimental fisheries, bycatch rates of harbor porpoises in pingered nets were less than in non-pingered nets.

A study on the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage which took place in both the Northeast and mid-Atlantic gillnet fisheries. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´N) in February~~, March and~~ April. Researchers purposely picked an area of historically high bycatch rates in order to have a chance of finding a significant difference. Eight research strings of fourteen nets each were fished and 159 hauls were completed during the course of the 2009–2010 study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Twelve harbor porpoises were caught in this project in 79 hauls during 2009 and one animal was caught in 72 hauls during the 2010 experiment in the Northeast (A.I.S., Inc. 2010). These animals were included in the observed interactions and added to the total estimates (Table 2), though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Average estimated harbor porpoise mortality and serious injury in the Northeast sink gillnet fishery during 1994-1998, before the Take Reduction Plan, was 1,163 (0.11). The average annual harbor porpoise mortality and serious injury in the Northeast sink gillnet fishery from ~~2006~~ 2007 ~~to~~ ~~2010~~ 2011 was ~~511~~ 473 (0.17) (Table 2).

Mid-Atlantic Gillnet

Before an observer program was in place for this fishery, Polacheck *et al.* (1995) reported one harbor porpoise incidentally taken in shad nets in the York River, Virginia. In July 1993 an observer program was initiated in the mid-Atlantic gillnet fishery by the NEFSC Sea Sampling program (Appendix III). Documented bycatch after 1995 was from December to May. Bycatch estimates were calculated using methods similar to that used for bycatch estimates in the Northeast sink gillnet fishery (Bravington and Bisack 1996; Bisack 1997). The estimated annual mortality (CV in parentheses) attributed to this fishery was 103 (0.57) for 1995, 311 (0.31) for 1996, 572 (0.35) for 1997, 446 (0.36) for 1998, 53 (0.49) for 1999, 21 (0.76) for 2000, 26 (0.95) for 2001, unknown in 2002, 76 (1.13) in 2003, 137 (0.91) in 2004, 470 (0.51) in 2005, 511 (0.32) in 2006, 58 (1.03) in 2007, 350 (0.75) in 2008, 201 (0.55) in 2009, ~~and~~ 257 (0.~~89~~88) in 2010 and 123 (0.41) in 2011; Orphanides 2013.

In the Northeast gillnet fishery section above, see the description of the study on the effects of two different hanging rations in the bottom-set gillnet fishery which took place in both the Northeast and mid-Atlantic gillnet fisheries. Ten harbor porpoises were caught in 8 hauls in the mid-Atlantic as part of this experiment (A.I.S., Inc. 2010). Harbor porpoises that were caught in this study were included in the observed interactions and added to the total estimates (Table 2), though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Annual average estimated harbor porpoise mortality and serious injury from the mid-Atlantic gillnet fishery during 1995 to 1998, before the Take Reduction Plan, was 358 (CV=0.20). The average annual harbor porpoise mortality and serious injury in the mid-Atlantic gillnet fishery from ~~2006~~ 2007 ~~to~~ ~~2010~~ 2011 was ~~275~~ 198 (~~0.29~~0.38) (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. Twenty harbor porpoise mortalities were observed in the Northeast bottom trawl fishery between 1989 and 2008, but many of these are not attributable to this fishery. Decomposed animals are presumed to have been dead prior to being taken by the trawl. One fresh dead take was observed in the Northeast bottom trawl fishery in 2003, 4 in 2005, 1 in 2006, ~~and~~ 1 in 2008, and 1 in 2011. Revised serious injury guidelines were applied for the period 2007-2011 (Waring *et al.* in prep.). One serious injury was observed in 2011. To estimate bycatch in this fishery, observer and mandatory vessel trip report data from the years 2005~~ through ~~-2009 were used in a stratified ratio-estimator. The estimated annual mortality (CV in parentheses) attributed to this fishery was 7.2 (0.48) for 2005, 6.5 (0.49) for 2006, 5.6 (0.46) for 2007, 5.3 (0.47) for 2008, 5.1 (0.50) for 2009, and 0 for 2010. No estimate was generated in 2011. Annual average estimated harbor porpoise mortality and serious injury from the northeast bottom trawl fishery from 2006 to 2010 is ~~4.5~~ 4.5~~0~~ (~~0.30~~0.27) (Table 2).

CANADA

Bay of Fundy Sink Gillnet

During the early 1980s, harbor porpoise bycatch in the Bay of Fundy sink gillnet fishery, based on casual observations and discussions with fishermen, was thought to be low. The estimated harbor porpoise bycatch in 1986 was 94-116 and in 1989 it was 130 (Trippel *et al.* 1996). The Canadian gillnet fishery occurs mostly in the western portion of the Bay of Fundy during the summer and early autumn months, when the density of harbor porpoises is highest. Polacheck (1989) reported there were 19 gillnetters active in 1986, 28 active in 1987, and 21 in 1988.

An observer program implemented in the summer of 1993 provided a total bycatch estimate of 424 harbor porpoises (± 1 SE: 200-648) from 62 observed trips, (approximately 11.3% coverage of the Bay of Fundy trips) (Trippel *et al.* 1996). During 1994, the observer program was expanded to cover 49% of the gillnet trips (171 observed trips). The bycatch was estimated to be 101 harbor porpoises (95% confidence limit: 80-122), and the fishing fleet consisted of 28 vessels (Trippel *et al.* 1996). During 1995, due to groundfish quotas being exceeded, the gillnet fishery was closed from July 21 to August 31. During the open fishing period of 1995, 89% of the trips were observed, all in the Swallowtail region. Approximately 30% of these observed trips used pingered nets. The estimated bycatch was 87 harbor porpoises (Trippel *et al.* 1996). No confidence interval was computed due to lack of coverage in the Wolves fishing grounds. During 1996, the Canadian gillnet fishery was closed during 20-31 July and 16-31 August due to groundfish quotas. From the 107 monitored trips, the bycatch in 1996 was estimated to be 20 harbor porpoises (DFO 1998; Trippel *et al.* 1999). Trippel *et al.* (1999) estimated that during 1996, gillnets equipped with acoustic alarms reduced harbor porpoise bycatch rates by 68% over nets without alarms in the Swallowtail area of the lower Bay of Fundy. During 1997, the fishery was closed to the majority of the gillnet fleet during 18-31 July and 16-31 August, due to groundfish quotas. In addition a time-area closure to reduce porpoise bycatch in the Swallowtail area occurred during 1-7 September. From the 75 monitored trips, 19 harbor porpoises were observed taken. After accounting for total fishing effort, the estimated bycatch in 1997 was 43 animals (DFO 1998). Trippel *et al.* (1999) estimated that during 1997, gillnets equipped with acoustic alarms reduced harbor porpoise bycatch rates by 85% over nets without alarms in the Swallowtail area of the lower Bay of Fundy. The number of monitored trips (and observed harbor porpoise mortalities were 111 (5) for 1998, 93 (3) for 1999, 194 (5) for 2000, and 285 (39) for 2001. The estimated annual mortality estimates were 38 for 1998, 32 for 1999, 28 for 2000, and 73 for 2001 (Trippel and Shepherd 2004). Estimates of variance are not available.

There has been no observer program during the summer since 2002 in the Bay of Fundy region, but the fishery is still active. Bycatch for these years is unknown. The annual average of most recent five years with available data (1997-2001) was 43 animals, so this value is used to estimate the annual average for more recent years. However, in 2011 there was little gillnet effort in New Brunswick waters in the summer; thus the Canadian porpoise by-catch estimates c~~w~~ould have been near zero. The fishermen that sought groundfish went into the mid-Bay of Fundy where traditionally by-catch levels were~~are~~ extremely low. Trippel (pers. comm.) estimated that less than 10 porpoise were bycaught in the Canadian fisheries in the Bay of Fundy in 2011. Analysis of port catch records might allow estimation of bycatch rates for the 2002~~-~~ ~~2010~~ 2011 period.

Herring Weirs

Harbor porpoises are taken in Canadian herring weirs, but there have been no recent efforts to observe takes in

the U.S. component of this fishery. Smith *et al.* (1983) estimated that in the 1980s approximately 70 harbor porpoises became trapped annually and, on average, 27 died annually. In 1990, at least 43 harbor porpoises were trapped in Bay of Fundy weirs (Read *et al.* 1994). In 1993, after a cooperative program between fishermen and Canadian biologists was initiated, over 100 harbor porpoises were released alive (Read *et al.* 1994). Between 1992 and 1994, this cooperative program resulted in the live release of 206 of 263 harbor porpoises caught in herring weirs. Mortalities (and releases) were 11 (50) in 1992, 33 (113) in 1993, and 13 (43) in 1994 (Neimanis *et al.* 1995). Since that time, additional harbor porpoises have been documented in Canadian herring weirs: mortalities (and releases, and unknowns) were 5 (60, 0) in 1995; 2 (4, 0) in 1996; 2 (24, 0) in 1997; 2 (26, 0) in 1998; 3 (89, 0) in 1999; 0 (13, 0) in 2000 (A. Read, pers. comm), 14 (296, 0) in 2001, 3 (46, 4) in 2002, 1 (26, 3) in 2003, 4 (53, 2) in 2004; 0 (19, 5) in 2005; 2 (14, 0) in 2006; 3 (9, 3) in 2007, 0 (8, 6) in 2008, 0 (3,4) in 2009, ~~and~~ 1 in 2010 (7, 0), and 0 (2, 3) in 2011. (Neimanis *et al.* 2004; H. Koopman and A. Westgate, pers. comm.).

Average estimated harbor porpoise mortality in the Canadian herring weir fishery during 2006~~-~~–2010 was 1.2 (Table 2). An estimate of variance is not possible.

Table 2. From observer program data, summary of the incidental mortality of Gulf of Maine/Bay of Fundy harbor porpoise (*Phocoena phocoena phocoena*) by commercial fishery including the years sampled ~~(Years)~~, the type of data used ~~(Data Type)~~, the annual observer coverage ~~(Observer Coverage)~~, the mortalities and serious injuries recorded by on-board observers ~~(Observed Mortality)~~, the estimated annual serious injury and mortality ~~(Estimated Mortality)~~, the estimated CV of the annual mortality, ~~(Estimated CVs)~~ and the mean annual combined mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury[i]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Combined Serious Injury	Estimated CVs	Mean Annual Combined Mortality
U.S.										
Northeast Sink Gillnet [c, h]	~~06~~07-~~10~~11	Obs. Data, Weighout, Trip Logbook	~~.04,~~ .07, .05, .04, .17, .19	0, 0, 0, 0, 0	~~26,~~ 35, 30, 45, 50, 66	0, 0, 0, 0, 0	~~514,~~ 395, 666, 591, 387, 324	395, 666, 591, 387, 324	~~.31,~~ .37, .48, .23, .~~30~~27, .20	~~511~~473 (0.17)
Mid-Atlantic Gillnet	~~06~~07-~~10~~11	Obs. Data Weighout	~~.04,~~ .06, .03, .03, .04, .02	0, 0, 0, 0, 0	~~20,~~ 1, 9, 7, 18, 11	0, 0, 0, 0, 0	~~511,~~ 58, 350, 201, 257, 123	58, 350, 201, 257, 123	~~.32,~~ 1.03, .75, .55, .~~89~~88, .41	~~275~~ 198 (~~.29~~0.38)
Northeast bottom trawl [g]	~~06~~07-~~10~~11	Obs. Data Weighout	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 0, 1	~~1,~~ 0, 1, 0, 0, 1	0, 0, 0, 0, na	~~6.5,~~ 5.6, 5.3, 5.1~~0~~, 0, na	5.6, 5.3, 5.10, 0, na	~~.49,~~ .46, .47, .50, 0, na	~~4.5~~ 4.5~~0~~ (~~0.30~~0.27)[g]
U.S. TOTAL	~~2006~~2007-~~2010~~2011									~~791~~ 675 (0.16)
CANADA										
Bay of Fundy Sink Gillnet [f]	1997-2001	Can. Trips	unk		19, 5, 3, 5, 39		43, 38, 32, 28, 73		unk	43 [f] (unk)
Herring Weir [d,e]	~~06~~07-~~10~~11	Coop. Data	unk		~~2,~~ 3, 0, 0, 1, 0		~~2,~~ 3, 0, 0, 1, 0		NA	~~1.2~~0.8 (unk)
CANADIAN TOTAL	2006-2010									44 (unk)
GRAND TOTAL										719~~835~~ (unk)

NA = Not available.

a. Observer data (Obs. Data) are used to measure bycatch rates; the U.S. data are collected by the Northeast

Fisheries Science Center (NEFSC) Sea Sampling Program and At-Sea Monitoring Program, the Canadian data are collected by DFO. NEFSC collects Weighout (Weighout) landings data that are used as a measure of total effort for the U.S. gillnet fisheries. The Canadian DFO catch and effort statistical system collected the total number of trips fished by the Canadians (Can. Trips), which was the measure of total effort for the Canadian groundfish gillnet fishery. Mandatory vessel trip report (VTR) (Trip Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery. Observed mortalities from herring weirs are collected by a cooperative program between fishermen and Canadian biologists (Coop. Data).

b. Observer coverage for the U.S. Northeast and mid-Atlantic coastal gillnet fisheries, is based on tons of fish landed. Northeast bottom trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes only samples collected from traditional fisheries observer, but not the fishery monitors. Monitor trips were incorporated for 2011, the first full year of monitor coverage.

c. Since 2002 in the Northeast gillnet fishery, harbor porpoises were taken on pingered strings within strata that required pingers but that stratum also had observed strings without pingers. For estimates made during 1998 and after, a weighted bycatch rate was applied to effort from both pingered and non-pingered hauls within a stratum. The weighted bycatch rate was:

$$\sum_{i}^{ping,non-ping} \frac{\#\,porpoise_i}{ss\,landings_i} \cdot \frac{\#\,hauls_i}{total\#\,hauls}$$

There were 10, 33, 44, 0, 11, 0, 2, 8, 6, 2, 26, 2, 4, 12, 2, 9, 6, 11, ~~and~~ 23, and 11 observed harbor porpoise takes on pinger trips from 1992 to ~~2010~~2011, respectively, that were included in the observed mortality column. In addition, there were 9, 0, 2, 1,1, 4, 0, 1, 7, 21, 33, 24, 7, 13, 20, ~~and~~ 41, and 11 observed harbor porpoise takes in 1995 to ~~2010~~2011, respectively, on trips dedicated to fish sampling versus dedicated to watching for marine mammals; these were also included in the observed mortality column.

d. There were 255 licenses for herring weirs in the Canadian Bay of Fundy region.

e. Data provided by H. Koopman pers. comm.

f. The Canadian gillnet fishery was not observed during 2002 and afterwards, but the fishery is still active; thus, the current bycatch estimate for this fishery is assumed to be the average estimate using last five years that the fishery was observed in (1997-2001).

g. Mortality estimates derived from takes observed by traditional fishery observers only. 2011 estimates were not calculated and the mean annual mortality values are averages of 2007–2010 only.

h. Thirteen harbor porpoises in the NE area and 10 in the mid-Atlantic were incidentally caught as part of a 2009-2010 NEFSC hanging ratio study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. These animals were included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in the estimation of the bycatch rate that was expanded to the rest of the fishery.

i. Serious injuries were evaluated for the 2007–2011 period using new guidelines and include both at-sea monitor and traditional observer data (Waring *et al.* in prep.)

Other Mortality

U.S.

There is evidence that harbor porpoises were harvested by natives in Maine and Canada before the 1960s, and the meat was used for human consumption, oil, and fish bait (NMFS 1992). The extent of these past harvests is unknown, though it is believed to have been small. Up until the early 1980s, small kills by native hunters (Passamaquoddy Indians) were reported. In recent years it was believed to have nearly stopped (Polacheck 1989) until media reports in September 1997 depicted a Passamaquoddy tribe member dressing out a harbor porpoise. Further articles describing use of porpoise products for food and other purposes were timed to coincide with ongoing legal action in state court.

~~During 2006, 73 harbor porpoises were reported stranded on Atlantic U.S. beaches. Eight of these were reported as having signs of human interaction, but in no case was cause of death directly attributable to these interactions. In fact, in three cases the human interaction was post-mortem. One of the human interaction mortalities~~

~~was classified as a fishery interaction (with no further detail), one as a boat collision, and one was involved in an oil spill.~~

During 2007, 79 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, six were reported as having signs of human interaction. One of these was classified as a fishery interaction, and one had signs of propeller wounds, although the marks appeared to have been made post-mortem.

During 2008, 58 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, four were reported as having signs of human interaction. One of these was classified as a fishery interaction.

During 2009, 65 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, three~~five~~ stranding mortalities were reported as having signs of human interaction, all of which were fishery interactions.

During 2010, 82~~64~~ harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, six~~five~~ stranding mortalities were reported as having signs of human interaction, two of which were reported to be fishery interactions.

During 2011, 164 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, nine stranding mortalities were reported as having signs of human interaction, three of which were reported to be fishery interactions.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

Table 3. Harbor Porpoise (*Phocoena phocoena phocoena*) reported strandings along the U.S. and Canadian Atlantic coast, 2007-2011.

Area	Year					**Total**
	2007	2008	2009	2010	2011	
Maine[f]	10	7	4	7	15	**43**
New Hampshire	0	0	0	5	1	**6**
Massachusetts[a, f, g]	22	25	19	28	102	**196**
Rhode Island[b]	1	1	1	0	4	**7**
New York[c,g]	10	3	9	1	11	**34**
New Jersey[e, f]	5	8	4	7	1	**25**
Pennsylvania	0	0	1	0	0	**1**
Delaware	3	0	0	2	0	**5**
Maryland	0	2	5	4	0	**11**
Virginia[e,g]	8	6	8	10	2	**34**
North Carolina[d]	20	6	14	18	28	**86**
TOTAL U.S.	**79**	**58**	**65**	**82**	**164**	**448**
Nova Scotia	4	6	6	5	13	**34**
Newfoundland and New Brunswick	1	4	2	1	0	**8**
GRAND TOTAL	**84**	**68**	**73**	**88**	**177**	**490**

a. In Massachusetts, during 2006 one stranding record was of an emaciated calf swimming in shallow water, but capture attempts were unsuccessful. One animal was taken to a rehab facility in 2007 and one in 2008. In 2011, 5 animals were released alive and one taken to rehab.

b. In Rhode Island one animal stranded alive in 2006 and was taken to rehab. In 2011, one animal classified as human interaction due to fluke amputation.

c. Includes one live animal in 2006 in New York.

d. In North Carolina, one animal was taken to rehab in 2006, and one animal immediately released in 2008.

e. In 2009, 3 harbor porpoises were classified as fishery interactions, 2 in VA and a third in NJ.

f. Six total HI cases in 2010; 2 in Massachusetts, 1 in Maine, 1 in North Carolina and 2 in New Jersey. One of the New Jersey records, one of the North Carolina records, and the Maine record were fishery interactions.

g. Nine total HI cases in 2011; 5 in Massachusetts, 1 in Rhode Island, 2 in New York and 1 in Virginia. Two of these Massachusetts animals and the Virginia animal were fishery interactions.

~~Table 3. Harbor Porpoise (*Phocoena phocoena phocoena*) reported strandings along the Atlantic U.S. and Canadian coasts, 2006-2010.~~

~~Area~~	~~Year~~					~~Total~~
	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	
~~Maine[f]~~	~~9~~	~~10~~	~~7~~	~~4~~	~~7~~	~~37~~
~~New Hampshire~~	~~1~~	~~0~~	~~0~~	~~0~~	~~5~~	~~6~~
~~Massachusetts[a, f]~~	~~23~~	~~22~~	~~25~~	~~19~~	~~28~~	~~117~~
~~Rhode Island[b]~~	~~3~~	~~1~~	~~1~~	~~1~~	~~0~~	~~6~~
~~New York[c]~~	~~11~~	~~10~~	~~3~~	~~9~~	~~1~~	~~34~~
~~New Jersey[e, f]~~	~~6~~	~~5~~	~~8~~	~~4~~	~~7~~	~~30~~
~~Pennsylvania~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~
~~Delaware~~	~~3~~	~~3~~	~~0~~	~~0~~	~~2~~	~~8~~
~~Maryland~~	~~2~~	~~0~~	~~2~~	~~5~~	~~4~~	~~13~~
~~Virginia[e]~~	~~9~~	~~8~~	~~6~~	~~8~~	~~10~~	~~41~~
~~North Carolina[d]~~	~~6~~	~~20~~	~~6~~	~~14~~	~~0~~	~~46~~
~~**TOTAL U.S.**~~	~~**73**~~	~~**79**~~	~~**58**~~	~~**65**~~	~~**64**~~	~~**339**~~
~~Nova Scotia~~	~~4~~	~~4~~	~~6~~	~~6~~	~~5~~	~~25~~
~~Newfoundland and New Brunswick~~	~~0~~	~~1~~	~~4~~	~~2~~	~~1~~	~~8~~
~~**GRAND TOTAL**~~	~~**77**~~	~~**84**~~	~~**62**~~	~~**73**~~	~~**70**~~	~~**366**~~

~~a. In Massachusetts, during 2006 one stranding record was of an emaciated calf swimming in shallow water, but capture attempts were unsuccessful. One animal was taken to a rehab facility in 2007 and one in 2008.~~

~~b. In Rhode Island one animal stranded alive in 2006 and was taken to rehab.~~

~~c. Includes one live animal in 2006 in New York.~~

~~d. In North Carolina, one animal was taken to rehab in 2006, and one animal immediately released in 2008.~~

~~e. In 2009, 3 harbor porpoises were classified as fishery interactions, 2 in VA and a third in NJ.~~

~~f. Five total HI cases in 2010, 2 in MA, 1 in ME and 2 in NJ. One of the NJ records and the ME record were fishery interactions.~~

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded between 1991 and 1996 on the coast of Nova Scotia (Hooker *et al.* 1997). Researchers with the Canadian Department of Fisheries and Oceans documented strandings on the beaches of Sable Island during 1970 to 1998 (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. On the mainland of Nova Scotia, a total of 8 stranded harbor porpoises were recorded between 1991 and 1996: 1 in May 1991, 2 in 1993 (July and September), 1 in August 1994 (released alive), 1 in August 1994, and 3 in 1996 (March, April, and July (released alive)). On Sable Island, 8 stranded dead harbor porpoises were documented, most in January and February; 1 in May 1991, 1 in January 1992, 1 in January 1993, 3 in February 1997, 1 in May 1997, and 1 in June 1997. Two strandings during May-June 1997 were neonates (> 80 cm). The harbor porpoises that stranded in the winter (January-February) were on Sable Island, those in the spring (March to June) were in the Bay of Fundy (2 in Minas Basin and 1 near Yarmouth) and on Sable Island (2), and those in the summer (July to September) were scattered along the coast from the Bay of Fundy to Halifax.

Whales and dolphins stranded since 1997 on the coast of Nova Scotia were recorded by the Marine Animal Response Society and the Nova Scotia Stranding Network, including 3 harbor porpoises stranded in 1997 (1 in April, 1 in June and 1 in July), 2 stranded in June 1998, 1 in March 1999, 3 in 2000 (1 in February, 1 in June, and 1 in August); 2 in 2001 (1 in July and 1 in December), 5 in 2002 (3 in July (1 released alive), 1 in August, and 1 in September (released alive)), 3 in 2003 (2 in May (1 was released alive) and 1 in June (disentangled and released alive)), 4 in 2004 (1 in April, 1 in May, 1 in July (released alive) and 1 in November), 6 in 2005 (1 in April (released alive), 1 in May, 3 in June and 1 in July), 4 in 2006 (1 in June, 1 in August, 1 in September, and 1 in December), 4 in 2007, 6 in 2008, 6 in 2009 (2 released alive), and 5 (~~one~~ 1 released alive) in 2010 and 13~~2~~ (4 released alive); Table 3).

Five dead stranded harbor porpoises were reported in 2005 by the Newfoundland and Labrador Whale Release and Strandings Program, 1 in 2007 and 4 in 2008, 2 in 2009 (one dead entangled and one live release), ~~and~~ 1 in 2010 and 0 in 2011 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010, 2011, 2012; Table 3).

~~USA~~ U.S. management measures taken to reduce bycatch

A ruling to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was published in the Federal Register (63 FR 66464) on 02 December 1998 and became effective 01 January 1999. The Gulf of Maine portion of the Harbor Porpoise Take Reduction Plan (HPTRP) pertains to all fishing with sink gillnets and other gillnets capable of catching regulated groundfish in New England waters, from Maine through Rhode Island. This portion of the rule includes time and areas closures, some of which are complete closures; others are closed to gillnet fishing unless pingers are used in the prescribed manner. Also, the rule requires those who intend to fish to attend training and certification sessions on the use of the technology. The mid-Atlantic portion of the plan pertains to waters west of 72º30'W longitude to the mid-Atlantic shoreline from New York to North Carolina. This portion of the rule includes time and area closures, some of which are complete closures; others are closed to gillnet fishing unless the gear meets certain restrictions. The MMPA mandates that the take reduction teams that developed the above take reduction measures periodically meet to evaluate the effectiveness of the plan and modify it as necessary. The Harbor Porpoise Take Reduction Team was reconvened in December 2007 to discuss updated harbor porpoise abundance and bycatch information. The Team recommended modifications to the plan to further reduce harbor porpoise bycatch in commercial fisheries. As a result, the HPTRP was amended on 19 February 2010 (75 FR 7383) to expand management areas and seasons in which pingers are required, as well as to increase efforts to monitor and enforce the plan. In addition, the New England portion of the HPTRP now includes consequence closure areas as a management measure strategy. These areas with historically high bycatch rates will close seasonally only if bycatch rates over two consecutive management seasons exceed a specified bycatch rate. This management strategy is intended to reduce harbor porpoise bycatch and to increase compliance with HPTRP regulations. Once triggered, these areas would remain in effect until bycatch levels achieve zero mortality rate goal (ZMRG) or until new management measures are implemented in these areas. The Coastal Gulf of Maine consequence closure area was triggered in 2012.~~-~~ The closure was originally scheduled for the October/November period but was delayed until February/March of 2013. In addition the Team met in November 2012, February, April and May 2013 ~~se~~with the intent to update the HPTRP.

STATUS OF STOCK

This is a strategic stock because average annual human-related mortality and serious injury exceeds PBR. The

total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The status of harbor porpoises, relative to OSP, in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated. On 7 January 1993, NMFS proposed listing the Gulf of Maine harbor porpoise as threatened under the Endangered Species Act (NMFS 1993). On 5 January 1999, NMFS determined the proposed listing was not warranted (NMFS 1999). On 2 August 2001, NMFS made available a review of the biological status of the Gulf of Maine/Bay of Fundy harbor porpoise population. The determination was made that listing under the Endangered Species Act (ESA) was not warranted, and this stock was removed from the ESA candidate species list (NMFS 2001).

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HARBOR SEAL (*Phoca vitulina concolor*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The harbor seal is found in all nearshore waters of the North Atlantic and North Pacific Oceans and adjoining seas above about 30ºN (Burns 2009; Desportes et alet al. 2010). In the western North Atlantic, they are distributed from the eastern Canadian Arctic and Greenland south to southern New England and New York, and occasionally to the Carolinas (Mansfield 1967; Boulva and McLaren 1979; Katona *et al.* 1993; Gilbert and Guldager 1998; Baird 2001;Desportes et alet al. 2010). Stanley *et al.* (1996) examined worldwide patterns in harbor seal mitochondrial DNA, which indicate that western and eastern North Atlantic harbor seal populations are highly differentiated. Further, they suggested that harbor seal females are only regionally philopatric, thus population or management units are on the scale of a few hundred kilometers. High philopatry has been reported in other North Atlantic populations (Goodman 1998; Andersen and Olsen 2010). Although the stock structure of the western North Atlantic population is unknown, it is thought that harbor seals found along the eastern U.S. and Canadian coasts represent one population (Temte *et al.* 1991; Andersen and Olsen 2010). In U.S. waters, breeding and pupping normally occur in waters north of the New Hampshire/Maine border, although breeding occurred as far south as Cape Cod in the early part of the twentieth century (Temte *et al.* 1991; Katona *et al.* 1993).

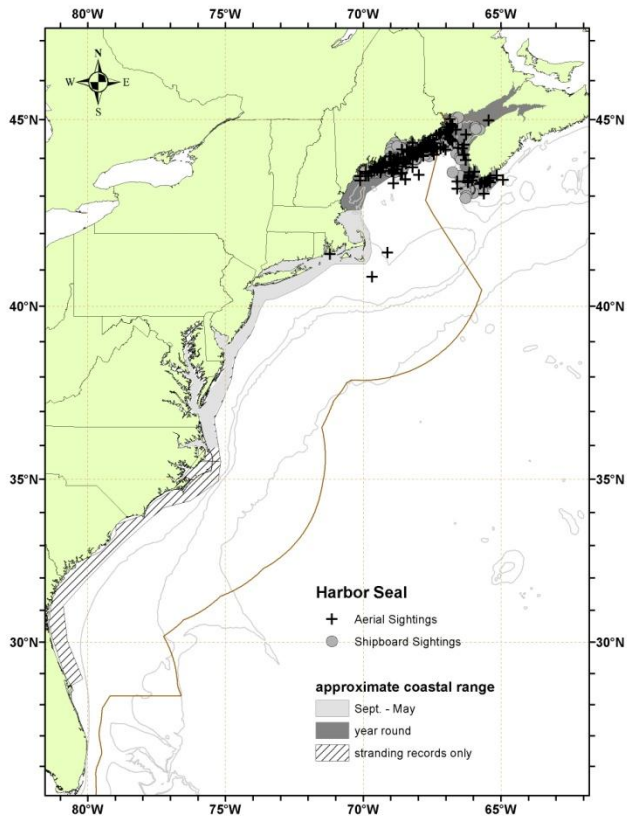

Figure 1. *Approximate coastal range of harbor seals.. Aand distribution of harbor seal sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, 2007, 2008, 2010, and 2011. –Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

Harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine (Katona et alet al. 1993), and occur seasonally along the southern New England to New Jersey coasts from September through late May (Schneider and Payne 1983; Barlas 1999; Schroeder 2000; deHart 2002). In recent years small numbers of seals (<50) have established winter haul-out sites in the Chesapeake Bay and near . In 2011 photographic evidence of a recently established seasonal haul out site at Oregon Inlet, North Carolina North Carolina was reported (Todd Pusser, pers. comm. June 2011; Virginia Institute of Marine Science -http://www.vims.edu/bayinfo/faqs/marine_mammal.php, accessed 14 February, 2013). Scattered sightings and strandings have been recorded as far south as Florida (NMFS unpublished data). A general southward movement from the Bay of Fundy to southern New England waters occurs in autumn and early winter (Rosenfeld *et al.* 1988; Whitman and Payne 1990; Barlas 1999; Jacobs and Terhune 2000). A northward movement from southern New England to Maine and eastern Canada occurs prior to the pupping season, which takes place from mid-May through June along the Maine Coast (Richardson 1976; Wilson 1978; Whitman and Payne 1990; Kenney 1994; deHart 2002). While eEarlier research identified no pupping areas in southern New England (Payne

and Schneider 1984; Barlas 1999); ~~-~~however, more recent anecdotal reports suggest that some pupping is occurring at high-use haulout sites off Manomet, Massachusetts. The overall geographic range throughout coastal New England has not changed significantly during the last century (Payne and Selzer 1989).

Prior to the spring 2001 live-capture and radio-tagging of adult harbor seals, it was believed that the majority of seals moving into southern New England and mid-Atlantic waters were subadults and juveniles (Whitman and Payne 1990; Katona *et al.* 1993). The 2001 study established that adult animals also made this migration. Seventy-five percent (9/12) of the seals tagged in March in Chatham Harbor were detected at least once during the May/June 2001 abundance survey along the Maine coast (Gilbert *et al.* 2005; Waring *et al.* 2006). Similar findings were made in spring 2012 work.

POPULATION SIZE

~~Since passage of the MMPA in 1972, the observed count of seals along the New England coast has been increasing.~~ Coast-wide aerial surveys along the Maine coast were conducted in May/June 1981, 1986, 1993, 1997, ~~and~~ 2001, and 2012~~1~~ during pupping (Gilbert and Stein 1981; Gilbert and Wynne 1983, 1984; Kenney 1994; Gilbert and Guldager 1998; Gilbert *et al.* 2005; Waring *et al*., in prep.). However, estimates older than eight years are deemed unreliable (Wade and Angliss 1997), and should not be used for PBR determinations. ~~Therefore, there is no current abundance estimate for harbor seals.~~ The 2001 survey, conducted in May/June, included replicate surveys and ~~radio-~~radio-tagged seals to obtain a correction factor for animals not hauled out. ~~Whereas, t~~The 2012 survey was designed (Waring *et al*., in prep) ~~-~~to sample bay units using a single aircraft, though ~~but~~it also included a radio-tracking aircraft and obtained a correction factor. ~~-~~The corrected estimates (pups in parenthesis) for 2001 and 2012, respectively, were ~~was~~ 99,340 (23,722) and ~~-~~70,141 (~22,000) (Table 1). The 2001 observed count of 38,014 was~~is~~ 28.7% greater than the 1997 count~~.~~, ~~-~~w~~W~~hereas~~,~~ the 2012 corrected estimate ~~i~~was 29.3% lower than the 2001 estimate. There are four possible reasons for the difference in the estimated number of harbor seals between 2001 and 2012. 1) The number of seals out of the water and available to be counted was estimated in 2012 as opposed to complete counting in 2001 (Waring *et al*. in prep (b); 2) The correction factor was different in the two surveys, being 2.54 in 2001 and 2.27 in 2012; 3). We did not sample where part of the population was during the survey; and 4). The population in no longer growing and has, in fact, declined.

~~. Increased abundance of seals in the Northeast region has also been documented during aerial and boat surveys of overwintering haul-out sites from the Maine/New Hampshire border to eastern Long Island and New Jersey (Payne and Selzer 1989; Rough 1995; Barlas 1999; Schroeder 2000; deHart 2002).~~

Canadian scientists counted 3,500 harbor seals during an August 1992 aerial survey in the Bay of Fundy (Stobo and Fowler 1994), but noted that the survey was not designed to obtain a population estimate. The Sable Island population was the largest in eastern Canada in the late 1980s, however ~~recently~~ the number ~~has~~ drastically declined in the late 1990s (Baird 2001). Similarly, pup production declined on Sable Island from 600 in 1989 to around a dozen pups or fewer by 2002 (Baird 2001; Bowen *et al.* 2003). A decline in the number of juveniles and adults did not occur immediately, but a decline was observed in these age classes as a result of the reduced number of pups recruiting into the older age classes (Bowen ~~et al~~*et al*. 2003). Possible reasons for this decline may be increased use of the island by gray seals and increased predation by sharks (Stobo and Lucas 2000; Bowen *et al.* 2003). Helicopter surveys have also been flown to count hauled-out animals along the coast and around small islands in parts of the Gulf of St. Lawrence and the St. Lawrence estuary. In the estuary, surveys were flown in June 1995, 1996, and 1997, and in August 1994, 1995, 1996, and 1997; different portions of the Gulf were surveyed in June 1996 and 2001 (Robillard *et al.* 2005). Changes in counts over time in sectors that were flown under similar conditions were examined at nine sites that were surveyed in June and in August. Although all slopes were positive, only one was significant, indicating numbers are likely stable or increasing slowly. Overall, the June surveys resulted in an average of 469 (SD=60, N=3) hauled-out animals, which is lower than the average count of 621 (SD=41, N=3) hauled-out animals flown under similar conditions in August. Aerial surveys in the Gulf of St. Lawrence resulted in counts of 467 animals in 1996 and 423 animals in 2001 for a different area (Robillard ~~et al~~*et al*. 2005). Further, approximately 200 harbor seals breed in the Grand Barachois on the islands of S. Pierre and Miquelon (France) off the southe coast of Newfoundland. This population has been declining since the mid 1980s, when there might have been more than 900 harbor seals there, due to disturbance by tourists and natural alterations of the tidal sand flats of the haul-out area (J. Lawson, pers. comm.. DFO, St. Johns, Newfoundland, 21 March 2013).

Table 1. Summary of abundance estimates for the western North Atlantic harbor seal. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
May/June 2012	Maine coast	70,142(~22,000)	0.29

Minimum Population Estimate

~~Present data are insufficient to calculate a minimum population estimate for this stock.~~

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. ~~–~~This is equivalent to the 20th percentile of the long-normal distribution as specified by Wade and Angleiss (1997). ~~-~~The best estimate of abundance for harbor seals is 70,142 (CV=0.29). The minimum population estimate is ~~48,980~~55,409 based on corrected available counts along the Maine coast in 2012.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~There are insufficient data to determine the population trends for this stock.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

A reliable estimate of the maximum net productivity rate is currently unavailable for this population. ~~Based on uncorrected haul-out counts over the 1981 to 2001 survey period, the harbor seal population was growing at approximately 6.6% (Gilbert et al~~*et al*~~, 2005). However, a population grows at the maximum growth rate (R_{max}) only when it is at a very low level; thus the 6.6% growth rate is not considered to be a reliable estimate of R_{max}.~~ For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate ~~(½ of 12%),~~ and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~48,980~~55,409 ~~-~~animals. The maximum productivity rate is 0.12, the default value for pinnipeds. ~~-~~The recovery factor (F_R) ~~for this stock~~ is 0.5, the default value for stocks of unknown status relative to optimum sustainable population (OSP), and because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). ~~.~~ ~~–~~PBR for the western North Atlantic stock of harbor seals is 1,~~469.~~662 ~~undetermined~~.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period ~~2006~~2007-~~2010~~ 2011 the total human caused mortality and serious injury to harbor seals is estimated to be ~~349~~407~~342~~ per year. The average was derived from two components: 1) ~~337~~ 389 (CV=0.~~15~~13; Table 2) from the 2007-2011~~2006-2010~~ observed fishery; and 2) ~~5~~12 from average 2007-2011~~2006-2010~~ non-fishery-related, human interaction stranding mortalities (NMFS unpublished data).

~~—~~ Researchers and fishery observers have documented incidental mortality in several fisheries, particularly within the Gulf of Maine (see below). An unknown level of mortality also occurred in the mariculture industry (i.e., salmon

farming), and by deliberate shooting (NMFS unpublished data). Between~~ 2006 and 2010~~, 2007 and 2011, there are ~~5~~4 records of harbor seals and 2 of unidentified seals with evidence of gunshot wounds in the Northeast Regional Office Marine Mammal Stranding Network database.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is given in Appendix III.

U.S.

Northeast Sink Gillnet:

Annual estimates of harbor seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. The fishery has been observed in the Gulf of Maine and in southern New England (Williams 1999; NMFS unpublished data). ~~There were 749658 harbor seal mortalities observed in the Northeast sink gillnet fishery between 1990 and 2010~~2011~~, excluding three animals taken in the 1994 pinger experiment (NMFS unpublished data) but including one animal taken in a hanging ratio experiment (see below).~~ Williams (1999) aged 261 harbor seals caught in this fishery from 1991 to 1997, and 93% were juveniles (i.e.,~~,~~ less than four years old). Estimated annual mortalities (CV in parentheses) from this fishery were ~~332 (0.33) in 1998, 1,446 (0.34) in 1999, 917 (0.43) in 2000, 1,471 (0.38) in 2001, 787 (0.32) in 2002, 542 (0.28) in 2003, 792 (0.34) in 2004, 719 (0.20) in 2005, 87 (0.58) in 2006,~~ 92 in 2007, 243 (0.41) in 2008, 516 (0.28) in 2009, ~~and 488~~ 459 (0.~~25~~26) in 2010, and 38~~2~~0 (0.2~~6~~1) in 2011 (Table 2; Orphanides 2013). The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996). There were ~~2, 9, 14, 8,~~ 14, 6, ~~-~~8, ~~and~~ 5, and 9 unidentified seals observed during ~~2003~~2007-2011~~2010~~, respectively. Since 1997, unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2007-2011~~2006-2010~~ was ~~285~~338 -harbor seals (CV=~~0.16~~0.14; Table 2).

Mid-Atlantic Gillnet

A study on the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´) in February, March and April. Eight research strings of fourteen nets each were fished, and 159 hauls were completed during the course of the study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh. There was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Four harbor seals (3 in mid-Atlantic gillnet and 1 –in NE gillnet) were caught in this project during 2010 (~~Schnaittacher~~ AIS ~~2011~~2010).

No harbor seals were taken in observed trips during 1993-1997, or 1999-2003. Two harbor seals were observed taken in 1998, 1 in 2004, 2 in 2005, 1 in 2006, 0 in 2007, 2 in 2008, 2 in 2009, ~~and~~ 9~~6~~ in 2010, and 2 in 2011. Using the observed and experimental takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 0 in 1995-1997 and 1999-2003, 11 in 1998 (0.77), 15 (0.86) in 2004, 63 (0.67) in 2005, 26 (0.98) in 2006, 0 in 2007, 88 (0.74) in 2008, ~~-4~~47 (0.68) in 2009, ~~and 89~~ 88 (0.~~41~~40) in 2010, and 2~~2~~1 (0.67) in 2011 (Table 2; Orphanides 2013). Average annual estimated fishery-related mortality and serious injury attributable to this fishery during 2007-2011~~2006-2010~~ was ~~50~~ 49 (CV =0.34) harbor seals (Table 2).

Northeast Bottom Trawl

~~Three~~ One harbor seal ~~mortalities~~ mortality ~~were~~ was observed in 2007, 0 in 2008, 1 in 2009, ~~and~~ 0 in 2010, and ~~x~~3 in 2011. (Table 2). The estimated annual fishery-related mortality and serious injury attributable to this fishery

has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2007-2011~~2006-2010~~ is calculated as 0.8 animals (4 animals/5 years).

Mid-Atlantic Bottom Trawl

One harbor seal mortality was observed in this fishery in 2010. (Table 2). The estimated annual fishery-related mortality and serious injury attributable to this fishery has not been generated~~.~~. Until this bycatch estimate can be developed, the average ~~-~~annual fishery-related mortality and serious injury for ~~2006~~2007-~~2010~~-2011 is calculated as 0.2 animals (1 animal/5 years).

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

One harbor seal mortality was observed in this fishery in 2009 and 2 in 2010 (Table 2). The resultant estimated annual fishery-related mortality and serious injury (CV in parentheses) was 1.3 (0.81) in 2009 but an extended bycatch rate has not been calculated for 2010. Until this bycatch estimate can be developed, the average ~~-~~annual fishery-related mortality and serious injury for ~~2006~~2007-~~2010~~-2011 is calculated as 0.7 animals (2 animals +1.3 animals/5 years).

Mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

~~-~~A harbor seal mortality was observed in this fishery in 2010. An expanded bycatch estimate has not been generated. ~~-~~Until this bycatch estimate can be developed, the average ~~-~~annual fishery-related mortality and serious injury for ~~2006~~2007-~~2010~~-2011 is calculated as 0.2 animals (1 animal/5 years).

Gulf of Maine Atlantic Herring Purse Seine Fishery

The Gulf of Maine Atlantic Herring Purse Seine Fishery is a Category III fishery. This fishery was not observed until 2003. No mortalities have been observed, but 11 harbor seals were captured and released alive in 2004,~~ and~~ 4 in 2005, 1 in 2008, ~~and~~ none in ~~2006~~2007 or 2009-2010, and 3 in 2011. In addition, 5 seals of unknown species were captured and released alive in 2004, 2 in 2005, 1 in 2007, and none in 2009-2010, and 8~~.~~ In 2011. ~~??~~This fishery was not observed in 2006. Further, one harbor seal and two unknown species in were designated as serious injuries/mortalities in 2011, based on fisheries monitoring logs (Waring *et al.* in prep.). An expanded bycatch estimate has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2007–2011 is calculated as 0.2 animals (1 animal/5 years).

CANADA

Currently, scant data are available on bycatch in Atlantic Canada fisheries due to a lack of observer programs (Baird 2001). An unknown number of harbor seals have been taken in Newfoundland, Labrador, Gulf of St. Lawrence and Bay of Fundy groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, Atlantic Canada cod traps, and in Bay of Fundy herring weirs (Read 1994; Cairns *et al.* 2000). Furthermore, some of these mortalities (e.g., seals trapped in herring weirs) are the result of direct shooting.

Table 2. Summary of the incidental mortality of harbor seals (*Phoca vitulina concolor*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury[e]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Northeast [c] Sink Gillnet	07-11	Obs. Data, Weighout, Logbooks	.07, .05, .04, .17, .19	0, 0, 0, 0, 0	6, 9, 21, 71, 91	0, 0, 0, 0, 0	93, 243, 516, 459, 380	93, 243, 516, 459, 380	.49, .41, .28, .26, .21	338 (0.14)

Mid-Atlantic Gillnet	07-11	Obs. Data, Weighout	.06, .03, .03, .04, .02	0, 0, 0, 0, 0	0, 2, 2, 9, 2	0, 0, 0, 0, 0	0, 88, 47, 89, 21	0, 88, 47, 89, 21	0, .74, .68, .41, .67	49 (0.34)
Northeast Bottom Trawl	07-11	Obs. Data, Weighout	.05, .08, .09, .16, .26	0, 0, 0, 0, 0	1, 0, 0, 0, 3	0, 0, 0, 0, 0	unk[d], 0, unk[d], unk[d],	unk[d], 0, unk[d], unk[d],	unk[d] ’ 0, unk[d], unk[d],	0.8 (na)[d]
Mid-Atlantic Bottom Trawl	07-11	Obs. Data Dealer	.03, .03. .05, .06, .08	0, 0, 0, 0, 0	0, 0, 0 ,1, 0	0, 0, 0, 0, 0	0, 0, 0, na[d] , 0	0, 0, 0, na[d] , 0	0, 0, 0, na[d] , 0	0.2 (na)[d]
Northeast Mid-water Trawl - Including Pair Trawl	07-11	Obs. Data Weighout Trip Logbook	.08, .199, .42, .53, .41	0, 0, 0, 0, 0	0, 0, 1, 2, 0	0, 0, 0, 0, 0	0, 0, 1.3, na[d] , 0	0, 0, 1.3, na[d] , 0	0, 0, .81, na[d] , 0	0.7 (.81)[d]
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	07-11	Obs. Data Weighout Trip Logbook	.039, .13, .13, .25, .41	0, 0, 0, 0, 0	0, 0, 0, 1, 0	0, 0, 0, 0, 0	0, 0, 0, na[d] , 0	0, 0, 0, na[d] , 0	0, 0, 0, na[d] , 0	0.2 (na)[d]
Herring Purse Seine	07-11	Obs. Data	. 32, .12, .21, .12 .33	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, na	0, 0, 0, 0, 0	0, 0, 0, 0, na	0, 0, 0, 0, na	0.2 (na)
TOTAL										389 (0.13)

[a] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (Weighout), and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery.

[b] The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic gillnet fisheries are ratios based on tons of fish landed and coverages for the northeast bottom trawl are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 and 2011 includes samples collected from traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP).

[c] Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 2007 - 2011, respectively, 2, 0, 8, 23 and 32 takes were observed in nets with pingers. In 2007 – 2011, respectively, 4, 9, 13, 48 and 59 takes were observed in nets without pingers.

[d] Analyses of bycatch mortality attributed to the northeast or mid-Atlantic bottom trawl fisheries for the years 2007-2011, or mid-water trawl fisheries for 2010 have not been generated.

e. Serious injuries were evaluated for the 2007–2011 period using new guidelines and include both at-sea monitor and traditional observer data (Waring *et al.* in prep.)

Other Mortality

Canada: Aquaculture operations in eastern Canada are licensed to shoot nuisance seals, but the number of seals killed is unknown (Jacobs and Terhune 2000; Baird 2001). Small numbers of harbor seals are taken in subsistence hunting in northern Canada, and Canada also issues personal hunting licenses which allow the holder to take six seals annually (DFO 2008).

U.S.: Historically, harbor seals were bounty-hunted in New England waters, which may have caused a severe decline of this stock in U.S. waters (Katona ~~et al~~*et al*. 1993; Lelli *et al*., 2009). Bounty-hunting ended in the mid-1960s.

Other sources of harbor seal mortality include human interactions, storms, abandonment by the mother, disease (Anthony *et al.* 2012), and predation (Katona *et al.* 1993; NMFS unpublished data; Jacobs and Terhune 2000). Mortalities caused by human interactions include boat strikes, fishing gear interactions, oil spill/exposure, harassment, and shooting.

~~Small numbers of h~~Harbor seals strand each year throughout their migratory range. Stranding data provide insight into some of these sources of mortality. From ~~2006~~2007-~~2010~~2011, ~~1,405~~1,272 harbor seal stranding mortalities were reported between Maine and Florida (Table 3; NMFS unpublished data). ~~Sixty five~~Seventy-seven (~~4.6%~~6.1%) of the dead seals stranded during this five-year period showed signs of human interaction (~~8 in 2006,~~ 21 in 2007, 10 in 2008, 6 in 2009, ~~and~~ 20 in 2010, and 20 in 2011-), with ~~24~~ 18 (1.4%) having some sign of fishery interaction (~~8 in 2006,~~ 5 in 2007, 5 in 2008, 0 in 2009, ~~and~~ 6 in 2010 and 2 in 2011). ~~Five~~ Four harbor seals during this period were reported as having been shot. An Unusual Mortality Event (UME) was declared for harbor seals in northern Gulf of Maine waters in 2003 and continued into 2004. No consistent cause of death could be determined. The UME was declared over in spring 2005 (MMC -2006). NMFS declared another UME in the Gulf of Maine in autumn 2006 based on infectious disease. A UME was declared in November of 2011 that involved 567 harbor seals stranding mortalities between June 2011 and October 2012 in Maine, New Hampshire and Massachusetts. The UME was declared closed in February 2013.

Stobo and Lucas (2000) have documented shark predation as an important source of natural mortality at Sable Island, Nova Scotia. They suggest that shark-inflicted mortality in pups, as a proportion of total production, was less than 10% in 1980-1993, approximately 25% in 1994-1995, and increased to 45% in 1996. Also, shark predation on adults was selective towards mature females. The decline in the Sable Island population appears to result from a combination of shark-inflicted mortality on both pups and adult females and inter-specific competition with the much more abundant gray seal for food resources (Stobo and Lucas 2000; Bowen *et al.* 2003).

Table 3. Harbor seal (*Phoca vitulina concolor*) stranding mortalities along the U.S. Atlantic coast (2007-2011) with subtotals of animals recorded as pups in parentheses[a].

State	2007[b]	2008	2009	2010	2011[c]	Total
~~ME~~Maine	106 (80)	178 (152)	72 (61)	70 (64)	147 (115)	573
~~NH~~New Hampshire	6 (5)	3 (2)	15 (12)	20 (15)	77 (63)	121
~~MA~~Massachusetts	51 (17)	50 (4)	74 (36)	82 (26)	133 (80)	390
~~RI~~Rhode Island	8 (1)	6 (4)	5 (2)	4 (0)	7 (0)	30
~~CT~~Connecticut	3	0	0	0	0	3
~~NY~~New York	11 (7)	5 (1)	14 (1)	15 (0)	17 (0)	62
~~NJ~~New Jersey	6	7	11 (2)	21 (0)	10 (0)	55
~~DE~~Delaware	0	1 (1)	0	0	0	1
~~MD~~Maryland	0	0	2 (0)	0	1 (0)	3
~~VA~~Virginia	0	1	3	1 (0)	4 (0)	9
~~NC~~North Carolina	0	6 (2)	6 (5)	11 (1)	2 (0)	25
Total	191	257	202	224	398	1272
Unspecified seals (all states)	34	51	34	9	11	139

a. Some of the data reported in this table differ from that reported in previous years. We have reviewed the records and made an effort to standardize reporting. Records of live releases and rehabbed animals have been eliminated. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.

b. Unusual Mortality Event (UME) declared for harbor seals in northern Gulf of Maine waters during 2006-2007.

c. Unusual Mortality Event (UME) declared for harbor seals in southern Maine to northern Massachusetts in 2011.

~~Table 3. Harbor seal (*Phoca vitulina concolor*) stranding mortalities along the U.S. Atlantic coast (2006-2010) with subtotals of animals recorded as pups in parentheses[a].~~

~~State~~	~~2006[b]~~	~~2007[b]~~	~~2008~~	~~2009~~	~~2010~~	~~Total~~
~~ME~~	~~371 (220)~~	~~106 (80)~~	~~178 (152)~~	~~76 (64)~~	~~70 (64)~~	~~801~~
~~NH~~	~~28 (19)~~	~~6 (5)~~	~~3 (2)~~	~~15 (12)~~	~~20 (15)~~	~~72~~
~~MA~~	~~94 (35)~~	~~51 (17)~~	~~50 (4)~~	~~74 (36)~~	~~82 (26)~~	~~351~~
~~RI~~	~~6 (3)~~	~~8 (1)~~	~~6 (4)~~	~~5 (2)~~	~~4 (0)~~	~~29~~
~~CT~~	~~2 (1)~~	~~3~~	~~0~~	~~0~~	~~0~~	~~5~~
~~NY~~	~~11~~	~~11 (7)~~	~~5 (1)~~	~~14 (1)~~	~~15 (0)~~	~~56~~
~~NJ~~	~~7~~	~~6~~	~~7~~	~~11 (2)~~	~~21 (0)~~	~~52~~
~~DE~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~MD~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~2~~
~~VA~~	~~2~~	~~0~~	~~1~~	~~3~~	~~1 (0)~~	~~7~~
~~NC~~	~~4~~	~~0~~	~~6 (2)~~	~~6 (5)~~	~~11 (1)~~	~~27~~
~~SC~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~
~~FL~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~Total~~	~~527~~	~~191~~	~~256~~	~~206~~	~~117~~	~~1405~~
~~Unspecified seals (all states)~~	~~46~~	~~34~~	~~51~~	~~34~~	~~22~~	~~187~~

~~a. Some of the data reported in this table differ from that reported in previous years. We have reviewed the records and made an effort to standardize reporting. Records of live releases and rehabbed animals have been eliminated. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.~~

~~b. Unusual Mortality Event (UME) declared for harbor seals in northern Gulf of Maine waters during 2006-2007.~~

STATUS OF STOCK

~~The species is~~Harbor seals are not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. ~~Although PBR cannot be determined for this stock, t~~The 2007-2011 average annual ~~level of~~ human-caused mortality and serious injury does not exceed PBR~~in the U.S. Atlantic EEZ is believed to be low relative to the total stock size; therefore, this is not a strategic stock~~. The status of the western North Atlantic harbor seal stock, relative to OSP, in the U.S. Atlantic EEZ is unknown. ~~The species is not listed as threatened or endangered under the Endangered Species Act.~~ Total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore,~~believed to be low relative to the population size in U.S. waters but~~ cannot be considered to be insignificant and approaching zero mortality and serious injury rate.

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GRAY SEAL (*Halichoerus grypus grypus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The gray seal is found on both sides of the North Atlantic, with three major populations: eastern Canada, northwestern Europe and the Baltic Sea (Katona *et al.* 1993). The western North Atlantic stock is equivalent to the eastern Canada population, and ranges from New York to Labrador (Davies 1957; Mansfield 1966; Katona *et al.* 1993; Lesage and Hammill 2001). This stock is separated by geography, differences in the breeding season, and mitochondrial DNA variation from the northeastern Atlantic stock (Bonner 1981; Boskovic *et al.* 1996; Lesage and Hammill 2001). There are ~~two~~three ~~–~~breeding concentrations in eastern Canada~~;~~ : ~~one a~~t Sable Island, Gulf of ~~and one that breeds on the pack ice in the Gulf of~~ St. Lawrence, and along the coast of Nova Scotia (Laviguer and Hammill 1993). Tagging studies indicate that there is little intermixing between the two breeding groups (Zwanenberg and Bowen 1990) and, for management purposes, they are treated by the Canadian ~~DFO~~ ~~(~~Department of Fisheries and Oceans (DFO)~~)~~ as separate stocks (Mohn and Bowen 1996). ~~-~~Outside the breeding period, there is overlap in the distribution of animals from the three colonies (Lavigueur and Hammill 1993; Harvey *et al.* 2008; Breed *et al.* 2006, 2009, Hammill, pers. comm.~~.~~ DFO, Mont-Joli, Quebec, Canada).~~–~~ In the mid- 1980s, small numbers of animals and pupping were observed on several isolated islands along the Maine coast and in Nantucket-Vineyard Sound, Massachusetts (Katona *et al.* 1993; Rough 1995: Gilbert ~~et al~~*et al*. 2005). In the late 1990s, a year-round breeding population of approximately 400+ animals was documented on outer Cape Cod and Muskeget Island (D. Murley, pers. comm., Mass. Audubon Society, Wellfleet, MA). In December 2001, NMFS initiated aerial surveys to monitor gray seal pup production on Muskeget Island and adjacent sites in Nantucket Sound, and Green and Seal Islands off the coast of Maine (Wood *et al.* 2007). To assess the stock structure of gray seals in the northwest Atlantic, tissue samples were collected from Canadian and US populations for genetic analyses (Wood ~~et al~~*et al*. 2011). Based on examination of nine highly variable microsatellite loci, all individuals were placed into one population. This provides additional confirmation that recolonization by Canadian gray seals is the source of the U.S. population.

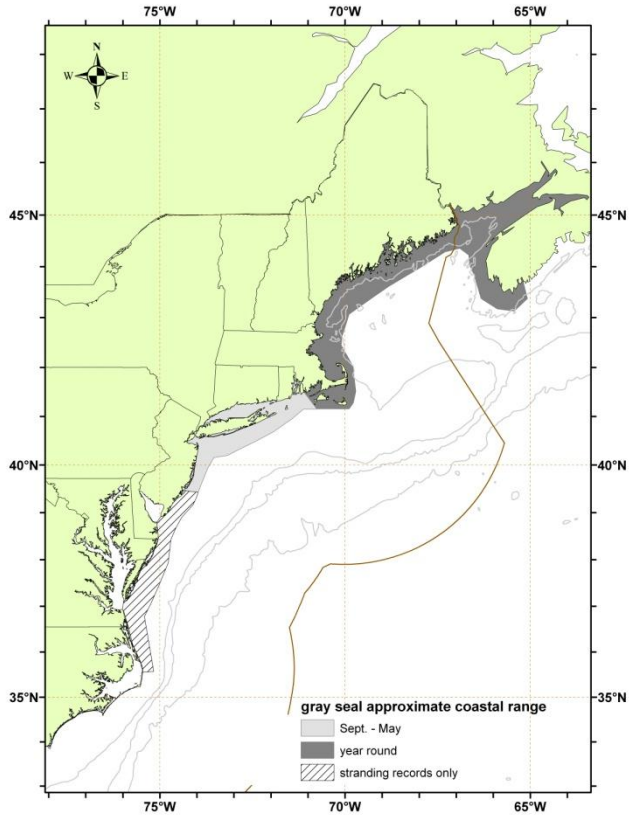

Figure 1. Approximate coastal range of gray seals. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.

POPULATION SIZE

Current estimates of the total western Atlantic gray seal population are not available; although estimates of portions of the stock are available for select time periods. The size of the total Canadian population from 1969-2012 has been estimated using updated age-specific reproductive rate data, and accounting for higher pup mortality in the Gulf of St. Lawrence breeding colony due to years with poor ice condition (DFO, 2012, in review; Hammill ~~et al~~*et al*. 2012, in review). For Sable Island the 2012 pup production estimate is 67,000 (95% CI=56,000 to 85,000), the total population size estimate of 262,000 (95% CI 219,000-332,000). ~~-~~Model estimates for coastal Nova Scotia were

2,300 (95% CI =1,100-3800) pups and a total population of 20,000 (95% CI= 17,000-23,000) in 2012. For the Gulf in 2012, pup production was estimated to be 7,000 (95% CI=2,900-15,200), and a total population of 49,000 (95% CI=27,000-102,000). The combined 2012 pup production is estimated to be 76,300 (95% CI=60,000-105,000), with a total population of 331,000 (95% CI=262,000-458,000). Difference between the total 2012 and 2010 (Thomas et al*et al*. 2011) estimates are due solely to differences in modeling approaches (DFO 2012, in review; Hammill et al*et al*. 2012, in review). The new model estimates replace the) 2010 pup production and total population estimates reported in Thomas et al*et al*. (2011). The size of the total Canadian population from 1977 to 2010 has been estimated by modeling gray seal population dynamics and available pup production data divided into three breeding regions: Sable Island, Gulf of St. Lawrence, and Coastal Nova Scotia (Thomas et al*et al*. 2011). The 2010 total population estimate was 348,900 (95% CI 291,300-414,900). This is 4% higher than the 2009 estimate (335,200; 95% CI 292,300-395,100) (Thomas et al*et al*. 2011). Average annual rates of total population increase were estimated to be 6% in the 1980s, 9% in the 1990s, and 6% in the 2000s. The authors note that these estimates should be treated with caution due to modeling and data concerns. In comparison to the pooled estimates, Bowen et al*et al*. (2003) reported that the Sable Island had been increasing by approximately 13% for nearly 40 years, but subsequently declined to 7% based on the 2004 pup production survey (Trzcinski et al*et al*. 2005; Bowen et al*et al*. 2007). The 2012 estimates suggest that the Sable Island population continued to increase at a rate of about 2.8% since 2010 (Hammill et al*et al*. 2012, in review). Whereas, the Ccoastal Nova Scotia and Gulf of St. Lawrence stocks do not appear to hasve shown much change in abundance since 2010 (DFO 2012, in review).

In U.S. waters, gray seals currently pup at three established colonies: Muskeget Island, Massachusetts, Green Island, Maine, and Seal Island, Maine, as well as, more recently, at Matinicus Rock and Mount Desert Rock in Maine. Although white coated pups have stranded on eastern Long Island beaches, no pupping colonies have been detected in that region. Gray seals have been observed using the historic pupping site on Muskeget Island in Massachusetts since 1990. Pupping has taken place on Seal and Green Islands in Maine since at least the mid 1990s. Aerial survey data from these sites indicate that pup production is increasing. A minimum of 2,620 pups (Muskeget= 2,095, Green= 59, Seal= 466) were born in the U.S. in 2008 (Wood LaFond 2009). Table 2 summarizes single-day pup counts from the three U.S. pupping colonies from 2001/2002 to 2007/2008 pupping periods. The decrease in pup counts in some years is an artifact of survey timing and not indicative of true declines in those years. In recent years NMFS monitoring surveys have detected an occasional mother/pup (white coats) pair on both Monomoy Island and Nomans Land in Massachusetts. Some of the local breeders have been observed with brands and tags indicating they had been born on Sable Island, Canada (Rough 1995; L. Sette, pers. comm., Provincetown Center for Coastal Studies). The increase in the number of gray seals observed in the U.S. is probably due to both natural increase and immigration.

Gray seals are also observed in New England outside of the pupping season. In April-May 1994 a maximum count of 2,010 was obtained for Muskeget Island and Monomoy combined (Rough 1995). Maine coast-wide surveys conducted during summer revealed 597 and 1,731 gray seals in 1993 and 2001, respectively (Gilbert *et al.* 2005). In March 1999 a maximum count of 5,611 was obtained in the region south of Maine (between Isles of Shoals, Maine and Woods Hole, Massachusetts) (Barlas 1999). In March 2011 a maximum count of 15,756 was obtained in southeastern Massachusetts coastal waters (NMFS unpubl. data). No gray seals were recorded at haul-out sites between Newport, Rhode Island and Montauk Pt., New York (Barlas 1999), currently although, more recently several hundred gray seals have been recorded in surveys conducted off eastern Long Island (R. DiGiovanni, pers. comm., The Riverhead Foundation for Research and Preservation, Riverhead, NY).

Table 1. Summary of abundance estimates for the western North Atlantic gray seal: year, and area covered during each abundance survey, resulting total abundance estimate and 95% confidence interval.

Month/Year	**Area**	**N_{best}**	**CI**
2010	Gulf of St Lawrence + Nova Scotia Eastern Shore + Sable Island	348,900	95% CI 291,300-414,900
2012	Gulf of St Lawrence + Nova Scotia Eastern Shore + Sable Island	331,000	95% CI 263,000-458,000

[a]These are model based estimates derived from pup surveys.

Table 2. The number of pups observed on Muskeget, Seal, and Green Islands 2002-2008. Data are from aerial

surveys. These are single-day counts, not estimates of total pup production. (Wood LaFond 2009).			
Pupping Season	Muskeget Island	Seal Island	Green Island
2001-2	883	No data	34
2002-3	509	147	No data
2003-4	824	150	26
2004-5	992	365	33
2005-6	868	239	43
2006-7	1704	364	57
2007-8	2095	466	59

Minimum Population Estimate

Based on modeling, the total Canadian gray seal population was estimated to be 331,000 (95% CI 263,000-458,000) (Hammill *et al.* 2012, in review). 348,999 (95% CI 291,300-414,900) (Thomas *et al.* 2011). Present data are insufficient to calculate the minimum population estimate for U.S. waters.

Current Population Trend

Gray seal abundance is likely increasing in the U.S. Atlantic Exclusive Economic Zone (EEZ), but the rate of increase is unknown. The population in eastern Canada was greatly reduced by hunting and bounty programs, and in the 1950s the gray seal was considered rare (Lesage and Hammill 2001). The Sable Island, Nova Scotia, population was less affected and has been increasing for several decades. Pup production on Sable Island, Nova Scotia, increased exponentially at a rate of 12.8% per year between the 1970s and 1997 (Stobo and Zwanenburg 1990; Mohn and Bowen 1996; Bowen *et al.* 2003; Trzcinski *et al.* 2005; Bowen *et al.* 2007; DFO 2011a), but has declined to about 4% per year between 2007 and 2010, and 2.8% from 2010 to 2012 (DFO 2011a;, DFO 2012). The non non-Sable Island population increased from approximately 25,000 in the mid-1980s to a peak of 71,500 in 2010 (Thomas *et al.* 2011). Modeling estimates of pup production increased from approximately 6,000 in 1985 to 17,400 in 2010 (Thomas *et al.* 2011). Approximately 70%- of the western North Atlantic population is from the Sable Island stock. In the early 1990s In recent years pupping ha was been established on Hay Island, off the Cape Breton coast (Lesage and Hammill 2001; Hammill et al*et al*. 2007, 2010).

Surveys of winter breeding colonies in Maine and on Muskeget Island may provide some measure of gray seal population trends and expansion in distribution. Sightings in New England increased during the 1980's as the gray seal population and range expanded in eastern Canada. Five pups were born at Muskeget in 1988. The number of pups increased to 12 in 1992, 30 in 1993, and 59 in 1994 (Rough 1995). In January 2002, 883 pups were counted on Muskeget Island and surrounding shoals (Wood Lafond 2009). In recent years NMFS monitoring surveys have detected an occasional mother/pup (white coats) pair on both Monomoy Island and Nomans Land. These observations continue the increasing trend in pup production reported by Rough (1995). The change in gray seal counts from southeastern Massachusetts (i.e., Monomoy, Muskeget and adjacent tidal bars) from 5,611 in spring 1999 to 15,756 in spring 2011 represents an annual increase of 8.6%, however, it has not been determined what proportion of the increase represents growth or immigration. For example, a few gray seals branded as pups on Sable Island in the 1970s and 2000s (Stobo and Zwanenburg 1990; C. den Heyer, pers. comm. DFO, Halifax), and satellite-tagged adults have been sighted in the Cape Cod region.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Recent studies estimated the current annual rate of increase at 2.8% between 2010 and 2012 7% on Sable Island (DFO 2012, in review), continuing a decline reported in in the rate of increase (Trzcinski et al*et al*. 2005; Bowen et al*et al*. 2007; Thomas et al*et al*. 2011). Overall, population growth in the three Canadian breeding herds appears to be leveling off (DFO 2012, in review). Trzcinski *et al.* 2005; Bowen *et al.* 2007), which represents a 45% decline from previous estimates (Mohn and Bowen 1996; Bowen *et al.* 2003). For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum

productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.12, the default value for pinnipeds. The recovery factor (F_R) for this stock is 1.0, the value for stocks of unknown status, but which are known to be increasing. PBR for the western North Atlantic gray seals in U.S. waters is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period 2007-2011~~2006-2010~~, the total estimated human caused mortality and serious injury to gray seals was 4,980~~5,250~~ per year. The average was derived from five components: 1) 1,120 (CV=0.11)~~850~~ (Table 3) from the 2007-2011~~2006-2010~~ U.S. observed fishery; 2) ~~6~~9 from average 2007-2011~~2006-2010~~ non-fishery related, human interaction stranding mortalities (NMFS unpublished data); 3) 750 ~~1,079~~ from average 2007-2011~~2006-2010~~ kill in the Canadian hunt (DFO in *review.*); 4) 82 ~~23~~ from DFO scientific collections (DFO in *review.*); and 5) 3,019~~3,292~~ removals of nuisance animals in Canada (DFO in *review.*).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is given in Appendix III.

U.S.

Northeast Sink Gillnet

Annual estimates of gray seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. There were 375 gray seal mortalities observed in the Northeast sink gillnet fishery between 1993 and 2010. Estimated annual mortalities (CV in parentheses) from this fishery were 0 in 1990-1992, 18 in 1993 (1.00), 19 in 1994 (0.95), 117 in 1995 (0.42), 49 in 1996 (0.49), 131 in 1997 (0.50), 61 in 1998 (0.98), 155 in 1999 (0.51), 193 in 2000 (0.55), 117 in 2001 (0.59), 0 in 2002, 242 (0.47) in 2003, 504 (0.34) in 2004, 574 (0.44) in 2005, 314 (0.22) in 2006, 886 (0.24) in 2007, 618 (0.23) in 2008, 1,063(0.26) in 2009, ~~and~~ 1,155(0.~~31~~28) in 2010, and 1,550 (.16) in 2011 (Table 3; Orphanides 2013). There were 2, 9, 14, 8, 14, 6, ~~8 and~~ ,7 and 9 unidentified seals observed during 2003-~~2010~~2011, respectively. Since 1997 unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2007-2011~~2006-2010~~ was ~~973~~ 1,054 gray seals (CV=0.11) (Table 3). The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996).

Mid-Atlantic Gillnet

Gray seal interactions were first observed in this fishery in 2010, when nine gray seal and 2 unidentified seal mortalities were observed. In 2011, 1 unidentified seal and 2 gray seal mortalities were observed in this fishery. ~~Average a~~Annual estimated fishery-related mortality and serious injury (CV in parentheses) to this stock attributable to this fishery ~~during 2010 was~~ 53 (~~CV=~~0.76) in 2012 and 19 (0.62) in 2011(Table 3; Orphanides 2013). Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2007-2011~~2006-2010~~ was 57 gray seals (CV=0.71) (Table 3).

Mid-Atlantic Mid-Water Trawl

One gray seal mortality was observed in 2010 in this fishery. An expanded bycatch estimate has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for ~~2006~~2007-~~2010~~ 2011 is calculated as 0.2 animals (1 animal /5 years).

Gulf of Maine Atlantic Herring Purse Seine Fishery

The Gulf of Maine Atlantic Herring Purse Seine Fishery is a Category III fishery. This fishery was not observed

until 2003, and was not observed in 2006. No mortalities have been observed, but 15 gray seals were captured and released alive in 2004, 19 in 2005, 0 in 2007, 6 in 2008, 0 in 2009, ~~and~~ 4 in 2010 and 34 in 2011. In addition, 5 seals of unknown species were captured and released alive in 2004, 2 in 2005, 1 in 2007 ~~and~~, none in 2008-2010 and 8 in 2011.

Northeast Bottom Trawl

Vessels in the North Atlantic bottom trawl fishery, a Category III fishery under MMPA, were observed in order to meet fishery management, rather than marine mammal management needs. No mortalities were observed prior to 2005, when four mortalities were attributed to this fishery. No mortalities were observed in 2006. The estimated annual fishery-related mortality and serious injury attributable to this fishery was 0 between 2001 and 2004, and for 2006. Nine gray seal mortalities were attributed to this fishery in 2007, 4 in 2008, ~~8~~ 5 in 2009, ~~and 9~~ 10 in 2010, and 18 in 2011. Estimates have not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2007-2011~~2006-2010~~ is calculated as ~~6~~9.2 animals (~~30~~46 animals /5 years).

CANADA

An unknown number of gray seals have been taken in Newfoundland and Labrador, Gulf of St. Lawrence, and Bay of Fundy groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, Atlantic Canada cod traps, and in Bay of Fundy herring weirs (Read 1994). In addition to incidental catches, some mortalities (e.g., seals trapped in herring weirs) were the result of direct shooting, and there were culls of about 1,700 animals annually during the 1970s and early 1980s on Sable Island (Anonymous 1986).

In 1996, observers recorded 3 gray seals (1 released alive) in Spanish deep-water trawl fishing on the southern edge of the Grand Banks (NAFO Areas 3) (Lens 1997). Seal bycatch occurred year-round, but interactions were highest during April-June. Many of the seals that died during fishing activities were unidentified. The proportion of sets with mortality (all seals) was 2.7 per 1,000 hauls (0.003).

Table 3. Summary of the incidental mortality of gray seal (*Halichoerus grypus grypus*) by commercial fishery including the years sampled, the type of data used, the annual observer coverage, the serious injuries and mortalities recorded by on-board observers, the estimated annual mortality, the estimated CV of the annual mortality and the mean annual combined mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury[e]	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Combined Mortality
Northeast Sink Gillnet[c]	07-11	Obs. Data,Weighout, Trip Logbook	.07, .05. 04, .17, .19	0, 0, 0, 0, 0	80, 31, 52, 107, 222	0, 0, 0, 0, 0	886, 618, 1063, 1155, 1550	886, 618, 1063, 1155, 1550	.24, .23, .26, .28, .16	1054 (0.11)
Mid-Atlantic Gillnet	07-11	Obs. Data, Trip Logbook, Allocated Dealer Data	.04, .03, .03, .04, .02	0, 0, 0, 0, 0	0, 0, 0, 9, 2	0, 0, 0, 0, 0	0, 0, 0, 265, 19	0, 0, 0, 265, 19	0, 0, 0, .76, .60	57 (0.71)
Northeast Bottom Trawl	07-11	Obs. Data,Trip Logbook	.06, .08, .09, .16, .26	0, 0, 0, 0, 0	9, 4, 5, 10, 18	0, 0, 0, 0, 0	unk d, unk [d], unk[d], unk [d], unk [d]	unk d, unk [d], unk[d], unk [d], unk [d]	unk d, unk [d], unk[d], unk [d], unk [d]	9.2 (na)[d]
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	07-11	Obs. Data, Trip Logbook	.039, .13, .13, .25, .41	0, 0, 0, 0, 0	0, 0, 0, 1, 0	0, 0, 0, 0, 0	0, 0, 0, na, 0	0, 0, 0, na, 0	0, 0, 0, unk d, 0	0.2 (na) [d]
TOTAL										1120 (0.11)

a. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. The Northeast Fisheries Observer Program collects landings data (Weighout), and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast multispecies sink gillnet fishery.
b. The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic gillnet fisheries are ratios based on tons of fish landed. . North Atlantic bottom trawl mid-Atlantic bottom trawl, and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the years 2010 and 2011 include traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP). c. Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 2007- 2011, respectively, 8, 4, 13, 17 and 125 takes were observed in nets with pingers. In 2007 -2011, respectively, 8, 72, 27, 39, 90, and 97 takes were observed in nets without pingers.
d. Analysis of bycatch mortality attributed to the Northeast bottom trawl fishery and midwater trawl fishery has not been generated. Unexpanded values are provisionally provided.
e. Serious injuries were evaluated for the 2007-2011 period using new guidelines (Waring *et al.* in prep.)

Table 3. Summary of the incidental mortality of gray seal (*Halichoerus grypus grypus*) by commercial fishery including the years sampled (Years), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the serious injuries and mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual combined mortality (CV in parentheses).

Fishery		Data Type[a]	Observer Coverage[b]	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Combined Mortality
Northeast Sink Gillnet[c]	06-10	Obs. Data, Weighout, Trip Logbook					

	~~07-11~~	~~Trip Logbook~~					

						~~unk~~ ~~d~~	

								~~(0.14)~~

~~a. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. The Northeast Fisheries Observer Program collects landings data (Weighout), and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast multispecies sink gillnet fishery.~~

~~b. The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic gillnet fisheries are ratios based on tons of fish landed. . North Atlantic bottom trawl mid-Atlantic bottom trawl, and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP). In the Northeast region 437 and 658 bottom trawl trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 bottom trawl trips were sampled by observers and monitors, respectively,~~

~~c. Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 2006- 2010, respectively, 1, 8, 4, 13, and 17 takes were observed in nets with pingers. In 2006 -2010, respectively, 8, 72, 27, 39, and 90 takes were observed in nets without pingers.~~

~~d. Analysis of bycatch mortality attributed to the Northeast bottom trawl fishery and midwater trawl fishery has not been generated. Unexpanded values are provisionally provided.~~

Other Mortality

Canada: In Canada, gray seals were hunted for several centuries by indigenous people and European settlers in the Gulf of St. Lawrence and along the Nova Scotia eastern shore, and were locally extirpated (Laviguer and Hammill 1993). Between 1999 and 2012~~2010~~ the annual kill of gray seals by hunters in Canada was: 1999 (98), 2000 (342), 2001 (76), 2002 (126), 2003 (6), 2004 (0), 2005 (1073), 2006 (1,857) 2007 (1747), 2008 (1,471), 2009 (263), ~~and~~ 2010 (58), 2011 (215) and 2012 (200). (DFO 2003; 2008; 2009; 2011b~~.~~; ~~DFO 2012,~~ in review; ~~M. Hammill pers. comm.~~). The traditional hunt of a few hundred animals is expected to continue off the Magdalen Islands and in other areas, except Sable Island where commercial hunting is not permitted (DFO 2003). DFO established a total allowable catch (TAC) of 12,000 gray seals for 2007 and 2008: -2,000 in the Gulf and 10,000 on the Scotian Shelf. The TAC for 2009 and 2010 was 50,000 seals, and for 2011 and 2012 it was set at 60,000. Since 2007, a small commercial hunt has taken place on Hay Island in Nova Scotia (http://www.dfo-mpo.gc.ca/fm-gp/seal-phoque/faq-eng.htm). The Hay Island TAC for 2010 was 2,220 (DFO 2011c), and for 2011 and 2012 it was set at 1,900(http://www.dfo-mpo.gc.ca/decisions/fm-2012-gp/atl-002-eng.htm, accessed 27 February 2013)). The hunting of gray seals will continue to be prohibited on Sable Island (~~http://www.dfo-mpo.gc.ca/seal-phoque/index_e.htm~~DFO 2011b).

Canada also issues personal hunting licenses which allow the holder to take six gray seals annually (Lesage and Hammill 2001; DFO 2011b). Hunting is not permitted during the breeding season and some additional seasonal/spatial restrictions are in effect (Lesage and Hammill 2001). Further, between 2005 and 2012~~2010~~ the lethal removal of nuisance seals was: 2005 (3105), 2006 (3437), 2007 (3373), 2008 (3334), 2009 (3381), ~~and~~ 2010 (2933), 2011 (2076), and 2012 (3000) (DFO 2011b).

For scientific collections, DFO took 87, 320, and 90 animals, respectively in 2007, 2011, and 2012 (DFO 2012, in review).

U.S: Gray seals, like harbor seals, were hunted for bounty in New England waters until the late 1960s (Katona, *et al.* 1993; Lelli, *et al*. 2009). This hunt may have severely depleted this stock in U.S. waters (Rough 1995; Lelli, *et al*. 2009). Other sources of mortality include human interactions, storms, abandonment by the mother, disease, and predation. Mortalities caused by human interactions include boat strikes, fishing gear interactions, power plant entrainment, oil spill/exposure, harassment, and shooting. Seals entangled in netting have been reported at several

major haul-out sites in the Gulf of Maine. ~~The Cape Cod stranding network has documented gray seals entangled in netting or plastic debris around the Cape Cod/Nantucket area, and in recent years have made successful disentanglement attempts.~~

From ~~2006~~ 2007 to ~~2010~~ 2011 ~~375~~ 488 gray seal stranding mortalities were recorded, extending from Maine to North Carolina (Table 4; NMFS unpublished data). Most stranding mortalities were in Massachusetts, which is the center of gray seal abundance in U.S. waters. ~~Sixty~~ Seventy-five (~~16.0~~15.4%) of the total stranding mortalities showed signs of human interaction (~~5 in 2006,~~ 8 in 2007, 21 in 2008, 14 in 2009, ~~and~~ 12 in 2010, and 20 in 2011), ~~with~~ 30 of which ~~having~~ had some indication of fishery interaction (~~5 in 2006,~~ 5 in 2007, 7 in 2008, 9 in 2009, ~~and~~ 4 in 2010, and 5 in 2011). ~~Four~~ Ten gray seals are recorded in the NE stranding database during the ~~2006~~ 2007 to ~~2010~~ 2011 period as having been shot – one in Maine in 2009 and one in Maine and two in Massachusetts in 2010 and 6 in Massachusetts in 2011.

Table 4. Gray seal (*Halichoerus grypus grypus*) stranding mortalities [a] along the U.S. Atlantic coast (2007-2011) with subtotals of animals recorded as pups in parentheses.

State	2007	2008	2009	2010	2011	Total
~~ME~~Maine	5 (1)	6 (1)	3	8 (4)	4 (2)	26
New Hampshire~~NH~~	1 (1)	0	1 (1)	0	8 (1)	10
MA	50 (9)	53 (4)	52 (7)	43 (5)	89 (14)	287
RI	5 (1)	7	10 (2)	8 (3)	14 (2)	44
CT	0	0	1(1)	0	2	3
NY	21 (17)	2 (2)	16 (7)	10 (7)	22 (6)	71
NJ	5 (2)	3	4	4 (1)	10	26
DE	0	1 (1)	0	0	0	1
MD	1	1	1	1	4 (2)	8
VA	1	1	2	1	1	6
NC	1 (1)	1 (1)	1 (1)	1	2 (2)	6
Total	90 (32)	75 (9)	91 (19)	76 (20)	156 (29)	488
Unspecified seals (all states)	34	51	34	22	11	152

a. Mortalities include those which stranded dead, died at site, were euthanized, died during transport, or died soon after transfer to rehab.

~~Table 4. Gray seal (*Halichoerus grypus grypus*) stranding mortalities [a] along the U.S. Atlantic coast (2006-2010) with subtotals of animals recorded as pups in parentheses.~~

~~State~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~Total~~
~~ME~~	~~3~~	~~5 (1)~~	~~6 (1)~~	~~3~~	~~8 (4)~~	~~25~~
~~NH~~	~~0~~	~~1 (1)~~	~~0~~	~~1 (1)~~	~~0~~	~~2~~
~~MA~~	~~29 (5)~~	~~50 (9)~~	~~53 (4)~~	~~52 (7)~~	~~43 (5)~~	~~227~~
~~RI~~	~~2 (2)~~	~~5 (1)~~	~~7~~	~~10 (2)~~	~~8 (3)~~	~~32~~
~~CT~~	~~0~~	~~0~~	~~0~~	~~1(1)~~	~~0~~	~~1~~
~~NY~~	~~6 (4)~~	~~21 (17)~~	~~2 (2)~~	~~16 (7)~~	~~10 (7)~~	~~55~~

~~NJ~~	~~1 (1)~~	~~5 (2)~~	~~3~~	~~4~~	~~4 (1)~~	~~17~~
~~DE~~	~~0~~	~~0~~	~~1 (1)~~	~~0~~	~~0~~	~~1~~
~~MD~~	~~0~~	~~1~~	~~1~~	~~1~~	~~1~~	~~4~~
~~VA~~	~~0~~	~~1~~	~~1~~	~~2~~	~~1~~	~~5~~
~~NC~~	~~2~~	~~1 (1)~~	~~1 (1)~~	~~1 (1)~~	~~1~~	~~6~~
~~Total~~	~~43 (12)~~	~~90 (32)~~	~~75 (9)~~	~~91 (19)~~	~~76 (20)~~	~~375~~
~~Unspecified seals (all states)~~	~~46~~	~~34~~	~~51~~	~~34~~	~~22~~	~~187~~
~~a. Mortalities include those which stranded dead, died at site, were euthanized, died during transport, or died soon after transfer to rehab.~~						

STATUS OF STOCK

Gray seals are~~The species is~~ not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act. The level of human-caused mortality and serious injury in the U.S. Atlantic EEZ is unknown, but believed to be very low relative to the total stock size~~; therefore, this is not a strategic stock~~. The status of the gray seal population relative to OSP in U.S. Atlantic EEZ waters is unknown, but the stock's abundance appears to be increasing in Canadian and U.S. waters. ~~The species is not listed as threatened or endangered under the Endangered Species Act.~~ The total U.S. fishery-related mortality and serious injury for this stock is low relative to the stock size in Canadian and U.S. waters and can be considered insignificant and approaching zero mortality and serious injury rate.

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HARP SEAL (*Pagophilus groenlandicus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The harp seal occurs throughout much of the North Atlantic and Arctic Oceans (Ronald and Healey 1981; Lavigne and Kovacs 1988). The world's harp seal population is divided into three separate stocks, each identified with a specific pupping site on the pack ice (Lavigne and Kovacs 1988; Bonner 1990). The largest stock is located off eastern Canada and is divided into two breeding herds. The Front herd breeds off the coast of Newfoundland and Labrador, and the Gulf herd breeds near the Magdalen Islands in the middle of the Gulf of St. Lawrence (Sergeant 1965; Lavigne and Kovacs 1988). The second stock breeds on the West Ice off eastern Greenland (Lavigne and Kovacs 1988), and the third stock breeds on the ice in the White Sea off the coast of Russia. The Front/Gulf stock is equivalent to western North Atlantic stock.

Harp seals are highly migratory (Sergeant 1965; Stenson and Sjare 1997). Breeding occurs at different times for each stock between late-February and April. Adults then assemble on suitable pack ice to undergo the annual molt. The migration then continues north to Arctic summer feeding grounds. In late September, after a summer of feeding, nearly all adults and some of the immature animals of the western North Atlantic stock migrate southward along the Labrador coast, usually reaching the entrance to the Gulf of St. Lawrence by early winter. There they split into two groups, one moving into the Gulf and the other remaining off the coast of Newfoundland. The southern limit of the harp seal's habitat extends into the U.S. Atlantic Exclusive Economic Zone (EEZ) during winter and spring.

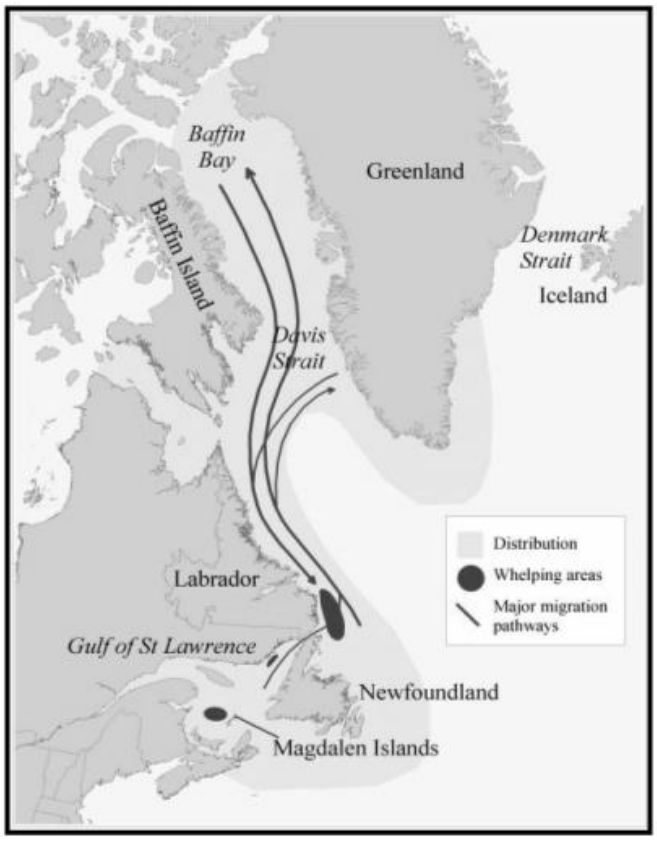

Figure 1: From: *Technical Briefing on the Harp Seal Hunt in Atlantic Canada*
http://www.dfo-mpo.gc.ca/misc/seal_briefing_e.htm

Since the early 1990s, numbers of sightings and strandings have been increasing off the east coast of the United States from Maine to New Jersey (Katona *et al.* 1993; Rubinstein 1994; Stevick and Fernald 1998; McAlpine 1999; Lacoste and Stenson 2000). These extralimital appearances usually occur in January-May (Harris *et al.* 2002), when the western North Atlantic stock of harp seals is at its most southern point of migration. Concomitantly, a southward shift in winter distribution off Newfoundland was observed during the mid-1990s, which was attributed to abnormal environmental conditions (Lacoste and Stenson 2000).

POPULATION SIZE

Abundance estimates for the western North Atlantic stock are available which use a variety of methods including aerial surveys and mark-recapture (Table 1). These methods involve surveying the whelping concentrations and estimating total population adult numbers from pup production. Roff and Bowen (1983) developed an estimation model to provide a more precise estimate of total abundance. This technique incorporates recent pregnancy rates and estimates of age-specific hunting mortality (CAFSAC 1992). This model has

subsequently been updated in Shelton *et al.* (1992), Stenson (1993), Shelton *et al.* (1996), and Warren *et al.* (1997). The revised 2000 population estimate was 5.5 million (95% CI= 4.5-6.4 million) harp seals. (Healey and Stenson 2000). The estimate based on the 2004 survey was calculated at 5.82 million (95% CI=4.1-7.6 million; Hammill and Stenson 2005) but has been subsequently revised to 5.5 million (95% CI=3.8 - 7.1 million; Table 1; DFO 2007). The 2008 and 2009 estimates, respectively, based on the 2008 survey of the Gulf and Front were 6.5 million (95% CI=5.7 to 7.3 million) and 6.9 million (95% CI=6.0 to 7.7 million; Table 1; DFO 2010). A revised model assuming density-dependent population growth, carrying capacity of 12 million and annual reproductive rate data was fitted to the 2008 survey data (DFO 2011~~ in review~~). The model estimated a total population 8.3 million (95% CI=7.5-8.9 million animals) increasing to 8.6 – 9.6 million (95% CI=7.8 to 10.8 million) animals in 2010. A population model was applied to 1952-2012 population ~~data~~estimates and the resultant total harp seal population size in 2012 was estimated to be 7.1 million animals (95% CI 5.9-8.3 million; Hammill *et al.* 2012). DFO flew a harp seal survey in 2012 and staff are completing counts of pups in the resultant imagery to estimate pup production and model population size.

Table 1. Summary of abundance estimates for western North Atlantic harp seals in Canadian waters. Year and area covered during each abundance survey, resulting abundance estimate (N_{best}) and confidence interval (CI).

Month/Year	Area	N_{best}	CI
2004	Front and Gulf	5.5 million	(95% CI 3.8-7.1 million)
2008	Front and Gulf	8.3 million	(95% CI 7.5-8.9 million)
2010	Front and Gulf	8.6-9.6 million	(95% CI 7.8-10.8 million)
2012	Front and Gulf	7.1 million	(95% CI 5.9-8.3 million)

Minimum population estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for western North Atlantic harp seals is ~~8.3 million (95% CI 7.5-8.9 million; DFO 2011~~7.1 million (95% CI 5.9-8.3 million; Hammill *et al.* 2012) ~~in review~~). Data are insufficient to calculate the minimum population estimate for U.S. waters.

Current population trend

Harp seal pup production in the 1950s was estimated at 645,000, but had decreased to 225,000 by 1970 (Sergeant 1975). Estimated number then began to increase and have continued to increase through the late 1990s, reaching 478,000 in 1979 (Bowen and Sergeant 1983; 1985), 577,900 (CV=0.07) in 1990 (Stenson *et al.* 1993), 708,400 (CV=0.10) in 1994 (Stenson *et al.* 2002), and 998,000 (CV=0.10) in 1999 (Stenson *et al.* 2003). The 2004 estimate of 991,000 pups (CV=0.06) was not significantly different from the 1999 estimate, which suggested that the increase in pup production observed throughout the 1990s may have abated (Stenson *et al.* 2005). However, the 2008 revised estimate of pup production is 1,630,300 (CV=6.8%), based on photographic and visual aerial survey counts (DFO 2011), and indicates that pup production had increased in intervening years since 1999. Estimated pup production in 2012 was 1.5 million animals (Hammill *et al.* 2012).

~~The population appears to be increasing in U.S. waters, judging from the increased number of stranded harp seals, but the magnitude of the suspected increase is unknown~~ The status of the population in U.S. waters is unknown. Recent increases in strandings may not be indicative of population size.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that

pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size in U.S. waters is unknown. The maximum productivity rate is 0.12, the default value for pinnipeds. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) was set at 1.0 the population is increasing. PBR for the western North Atlantic harp seal in U.S. waters is unknown. The PBR for the stock in U.S. waters is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period ~~2006~~2007 ~~-~~ ~~2010~~ 2011 the total estimated annual human caused mortality and serious injury to harp seals was ~~379,672~~306,082. This is derived from three components: 1) an average catch of ~~379,387~~ 305,804 seals from ~~2006~~2007-~~2010~~ 2011 by Canada and Greenland, including bycatch in the lumpfish fishery (Table 2a); 2) ~~281~~ 271 harp seals (CV=0.19) from the observed U.S. fisheries (Table 2b); and 3) an average of ~~4~~ 7 stranded seals from ~~2006~~2007-~~2010~~ 2011 that showed signs of ~~non~~ non-fishing human interaction.

Table 2a. Summary of the Canadian directed catch and bycatch incidental mortality of harp seal (*Pagophilus groenlandicus*) by year

Fishery	**2007**	**2008**	**2009**	**2010**	**2011**	**Average**
Commercial catches[a]	224,745	217,850	76,688	69,101	40,370	**125,751**
Commercial catch struck and lost[b]	14,914	11,736	4,035	4,060	2,078	**7,365**
Greenland subsistence catch[c]	82,836	80,556	71,046	83,669	77,800	**79,181**
Canadian Arctic[d]	1,000	1,000	1,000	1,000	1,000	**1,000**
Greenland and Canadian Arctic struck and lost[e]	83,836	81,556	72,046	84,669	78,800	**80,181**
Newfoundland lumpfish[f]	12,330	12,330	12,330	12,330	12,330	**12,330**
Total	**419,661**	**405,028**	**237,125**	**254,829**	**212,378**	**305,804**

a. Hammill and Stenson 2003, DFO 2003, DFO 2005, DFO 2010; ICES 2011; Hamill *et al.* 2012

b. Struck and lost is calculated for the commercial harvest assuming that the rate is 5% for young of the year, and 50% for animals one year of age and older (DFO 2001, Stenson unpublished data).

c. ICES 2003, 2011 DFO 2005, 2010; Hamill ~~et al~~*et al*. 2012

d. Hammill and Stenson 2003; Hamill ~~et al~~*et al*. 2012

e. The Canadian Arctic and Greenland struck and lost rate is calculated assuming the rate is 50% for all age classes (DFO 2001; Stenson unpublished data).

~~Table 2a. Summary of the Canadian directed catch and bycatch incidental mortality of harp seal (*Pagophilus groenlandicus*) by year~~

~~**Fishery**~~	~~**2006**~~	~~**2007**~~	~~**2008**~~	~~**2009**~~	~~**2010**~~	~~**Average**~~
~~Commercial catches[a]~~	~~354,867~~	~~224,745~~	~~217,85~~	~~76,66~~	~~69,101~~	~~**188,646**~~
~~Commercial catch struck and lost[b]~~	~~26,674~~	~~14,914~~	~~11,736~~	~~4,035~~	~~4,060~~	~~**12,284**~~
~~Greenland subsistence catch[c]~~	~~92,210~~	~~82,836~~	~~80,556~~	~~71,046~~	~~83,669~~	~~**82,063**~~
~~Canadian Arctic[d]~~	~~1,000~~	~~1,000~~	~~1,000~~	~~1,000~~	~~1,000~~	~~**1,000**~~

~~Greenland and Canadian Arctic struck and lost[e]~~	~~93,210~~	~~83,836~~	~~81,556~~	~~72,046~~	~~84,669~~	~~**83,063**~~
~~Newfoundland lumpfish[f]~~	~~12,330~~	~~12,330~~	~~12,330~~	~~12,330~~	~~12,330~~	~~**12,330**~~
~~**Total**~~	~~**580,291**~~	~~**419,661**~~	~~**405,028**~~	~~**237,125**~~	~~**254,829**~~	~~**379,387**~~

~~a. Hammill and Stenson 2003, DFO 2003, DFO 2005, DFO 2010; ICES 2011; Stenson unpublished data~~

~~b. Struck and lost is calculated for the commercial harvest assuming that the rate is 5% for young of the year, and 50% for animals one year of age and older (DFO 2001, Stenson unpublished data).~~

~~c. ICES 2003, 2011 DFO 2005, 2010; Stenson unpublished data~~

~~d. Hammill and Stenson 2003; Stenson unpublished data;~~

~~e. The Canadian Arctic and Greenland struck and lost rate is calculated assuming the rate is 50% for all age classes (DFO 2001; Stenson unpublished data).~~

~~f. DFO 2005; Stenson unpublished data; 2001-2004 average used.~~

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998;~~,~~ Andersen *et al*. 2008;~~,~~ NOAA 2012). -NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". –Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

U.S.

Detailed fishery information is reported in the Appendix III.

Northeast Sink Gillnet:

Annual estimates of harp seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. There were ~~208~~ 212 harp seal mortalities observed in the Northeast sink gillnet fishery between 1990 and ~~2010~~2011. The bycatch occurred principally in winter (January-May) and was mainly in waters from New Hampshire south to the shelf and shelf-edge waters southwest of Cape Cod. The stratification design used for this species is the same as that for harbor porpoise (Bravington and Bisack 1996). Estimated annual mortalities (CV in parentheses) from this fishery were: 81 (0.78) in 1999, 24 (1.57) in 2000, 26 (1.04) in 2001, 0 during 2002-2003, 303 (0.30) in 2004, 35 (0.68) in 2005, 65 (0.66) in 2006, 119 (0.35) in 2007, 238 (0.38) in 2008, 415 (0.27) in 2009, ~~and~~ 253 (0.62) in 2010, and 15 (0.58) in 2011 (Table 2b; Orphanides 2013). There were also 2, 9, 14, 8, 18, 6, 8, ~~and~~ 5, and 9 unidentified seals observed during 2003 through ~~2010~~ 2011 respectively. Since 1997, unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during ~~2006~~2007-~~2010~~ 2011 was ~~218~~ 208 harp seals (CV=~~0.20~~0.21) (Table 2b).

A study on the effects of two different hanging ratios in the bottom set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010. Commercial fishing vessels from Massachusetts and New Jersey were used for the study which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´) in February, March and April. One hundred fifty-nine hauls with eight research strings each were completed during the course of the study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Nine harp seals were caught in this project during 2009 and one during 2010 (A.I.S. Inc 2010). These animals are included in the observed interactions and added to the total estimates (Table 2b), though these interactions and their associated fishing effort were not included in bycatch rate calculations.

Mid-Atlantic Gillnet:

No harp seals were taken in observed trips during 1993-1997 or 1999-2006. One harp seal was observed taken in both 1998 and 2007, 4 were taken in 2008, 3 in 2009, ~~and~~ 1 in 2010 and 0 in 2011. All bycatches were

documented during January to April. Using the observed takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 0 in 1995-1997, 17 in 1998 (1.02), 0 in 1999-2006 38 in 2007, 176 (0.74) in 2008, 70 (0.67) in 2009, ~~and~~ 32 (0.93) in 2010, and 0 in 2011 (Table 2b; Orphanides 2013). Average annual estimated fishery-related mortality attributable to this fishery during ~~2006~~2007-~~2010~~-2011 was 63 harp seals (CV=0.46) (Table 2b).

Northeast Bottom Trawl

~~Four~~ Five mortalities were observed in the Northeast bottom trawl fishery between 2002 and ~~2010~~2011. The estimated annual fishery-related mortality and serious injury attributable to this fishery (CV in parentheses) was 0 between 1991 and 2000, 49 (CV=1.10) in 2001, and 0 in 2002-2004, and 0 in 2006–2008, and 2010. Estimates have not been generated for ~~2005~~ 2009 or ~~2009~~2011.

Table 2b. Summary of the incidental mortality of harp seal (*Pagophilus groenlandicus*) by commercial fishery including the years sampled (Years), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).

Fishery	Years	Data Type [a]	Observer Coverage [b]	Observed Serious Injury [f]	Observed Mortality [c]	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet [e]	07-11	Obs. Data, Trip Logbook, Allocated Dealer Data	.07, .05, .04, .17, .19	0, 0, 0, 0, 0	11, 14, 32, 8, 4	0, 0, 0, 0, 0	119, 238, 415, 253, 15	119, 238, 415, 253, 15	.35, .38, .27, .62, .52	208 (0.21)
Mid-Atlantic Gillnet	07-11	Obs. Data, Trip Logbook, Allocated Dealer Data	.05, .03, .03, .04, .02	0, 0, 0, 0, 0	1, 4, 3, 1, 0	0, 0, 0, 0, 0	38, 176, 70, 32, 0	38, 176, 70, 32, 0	0.9, .74, .67, .97, 0	63 (0.46)
Northeast Bottom Trawl [d]	07-11	Obs. Data Weighout	.06, .08, .09, .16, .26	0, 0, 0, 0, 0	0, 0, 1, 0, 1	0, 0, 0, 0, 0	0, 0, unk, 0, unk	0, 0, unk, 0, unk	0, 0, unk, 0, unk	0.4 (na) [d]
TOTAL										271 (0.19)

a. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. The Northeast Fisheries Observer Program collects landings data (Weighout) and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery. The 2010 and 2011 observer coverage in the NE sink gillnet fishery includes the At Sea Monitoring Program coverage.

b. The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic coastal sink gillnet fisheries are ratios based on tons of fish landed. North Atlantic bottom trawl fishery coverages are ratios based on trips.

c. Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 2000-2011, respectively, 2, 1, 0, 0, 4, 0, 3, 0, 3, 4, 1 and 4takes were observed in nets with pingers. In 2000-2011, respectively, 1, 0, 0, 0, 11, 3, 0, 12, 15, 28, 6, and 0 takes were observed in nets without pingers.

d. Bycatch estimates attributed to the Northeast bottom trawl fishery have not been generated. Unexpanded values are provisionally provided.

e. Nine harp seals in 2009 and 1 in 2010 were incidentally caught as part of a NEFSC hanging ratio study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. These animals were included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in bycatch rate calculations.

f. Serious injuries were evaluated for the 2007–2011 period using new guidelines (Waring *et al.* in prep.)

Other Mortality

Canada: Harp seals have been commercially hunted since the mid-1800s in the Canadian Atlantic (Stenson 1993). A total allowable catch (TAC) of 200,000 harp seals was set for the large vessel hunt in 1971. The TAC varied until

1982 when it was set at 186,000 seals and remained at this level through 1995 (Stenson 1993; ICES 1998). The TAC was increased to 250,000 and 275,000, respectively, in 1996 and 1997 (ICES 1998). The 1997 TAC remained in effect through 2002. In 2003, a three-year TAC was set at 975,000 with a maximum of 350,000 allowed in the first two years (ICES 2008). As a result of catches in the first two years the 2005 TAC was set at 319,517 (ICES 2008). The 2006 TAC was increased to 335,000 (325,000 commercial hunt, 6,000 Aboriginal initiative, and 2,000 allocation each for personal use and Arctic catches). The TAC was reduced to 270,000 in 2007 (263,140 commercial hunt, 4,860 for Aboriginal, and 2,000 for personal use) (ICES 2008). In 2008 the TAC was increased to 275,000 (268,050 commercial hunt, 4,950 for Aboriginal, and 2,000 for personal use). In 2009 the TAC was 280,000, it was increased to 330,000 in 2010, and to 400,000 in 2011 (DFO 2011). In recent years hunters have harvested only a small portion (<10%) of the TAC since there are currently few markets for these seal products.

U.S.: From 2006 2007 to 2010 2011, 487 555 harp seal stranding mortalities were reported (Table 3; NMFS unpublished data). Nineteen Thirty-seven (4.3 36.7%) of the mortalities during this five-year period showed signs of human interaction (2 in 2006, 6 in 2007, 3 in 2008, 6 in 2009, 15 in 2010 and 7 in 2011), and 4 of which having with some sign of fishery interaction (1each in 2007 and 2008 and 2 in 2009, and 2 in 2010)). However, the cause of death of stranded animals is not being evaluated (interactions may be non-fatal or even post-mortem). Harris and Gupta (2006) analyzed NMFS 1996-2002 stranding data and suggested that the distribution of harp seal strandings in the Gulf of Maine was is consistent with the species' seasonal migratory patterns in this region.

Table 3. Harp seal (*Pagophilus groenlandicus*) stranding mortalities [a] along the U.S. Atlantic coast (2007–2011) with subtotals of animals recorded as pups in parentheses.

State	2007	2008	2009	2010	2011	Total
MEMaine	8	15	9	13	6	51
NHNew Hampshire	1	1	4	1	0	7
MAMassachusetts	51 (2)	51	59 (2)	45	51 (1)	96
RIRhode Island	2	5	9	5	7	28
CTConnecticut	1	2	3	5	4	15
NYNew York	19 (1)	8	29	22	38 (1)	59
NJNew Jersey	3	12	5	9	16	45
DEDelaware	2	0	0	1	1	2
MDMaryland	4	1	2	2	2	3
VAVirginia	5	3	1	2	2	5
NCNorth Carolina	0	0	0	0	0	3
Total	**96**	**98**	**121**	**105**	**135**	**555**
Unspecified seals (all states)	34	51	34	22	11	152

a. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.

Table 3. Harp seal (*Pagophilus groenlandicus*) stranding mortalities [a] along the U.S. Atlantic coast (2006-2010) with subtotals of animals recorded as pups in parentheses.

State	2006	2007	2008	2009	2010	Total
ME	14	8	15	9	13	59

NH	0	1	1	4	1	7
MA	24	51 (2)	51	59 (2)	45	230
RI	6	2	5	9	5	27
CT	4	1	2	3	5	15
NY	15	19 (1)	8	29	22	93
NJ	3 (1)	3	12	5	9	32
DE	0	2	0	0	1	3
MD	0	4	1	2	2	9
VA	0	5	3	1	2	11
NC	1	0	0	0	0	1
Total	**67**	**96**	**98**	**121**	**105**	487
Unspecified seals (all states)	46	34	51	34	22	187
a. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.						

STATUS OF STOCK

The species isHarp seals are not listed as threatened or endangered under the Endangered Species Act and the western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act.. The The level of human-caused mortality and serious injury in the U.S. Atlantic EEZ is also low relative to the total stock size; therefore, this is not a strategic stock. The status of the harp seal stock, relative to OSP, in the U.S. Atlantic EEZ is unknown, but the stock's abundance appears to have stabilized. The species is not listed as threatened or endangered under the Endangered Species Act. The The total U.S. fishery-related mortality and serious injury for this stock is very low relative to the stock size and can be considered insignificant and approaching zero mortality and serious injury rate.

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ATLANTIC SPOTTED DOLPHIN (*Stenella frontalis*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Atlantic spotted dolphins are distributed in tropical and warm temperate waters of the western North Atlantic (Leatherwood *et al.* 1976). Their distribution ranges from southern New England, south through the Gulf of Mexico and the Caribbean to Venezuela (Leatherwood *et al.* 1976; Perrin *et al.* 1994). Atlantic spotted dolphins regularly occur in ~~the inshore waters south of Chesapeake Bay~~continental shelf waters south of Cape Hatteras and ~~near the~~in continental shelf edge and continental slope waters north of this region (Figure 1; Payne *et al.* 1984; Mullin and Fulling 2003). Sightings have also been made along the north wall of the Gulf Stream and warm-core ring features (Waring *et al.* 1992).

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin, *Stenella frontalis*, ~~formerly *S. plagiodon*,~~ and the pantropical spotted dolphin, *S. attenuata* (Perrin *et al.* 1987). The Atlantic spotted dolphin occurs in two forms or ecotypes, which may be distinct sub-species (Perrin *et al.* 1987, 1994; Rice 1998): the large, heavily spotted form ~~which~~ that inhabits the continental shelf and is usually found inside or near the 200 m isobath; and the smaller, less spotted island and offshore form which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Fulling *et al.* 2003; Mullin and Fulling 2003; Mullin and Fulling 2004). Where they co-occur, the offshore ecotype~~form~~ of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea.

A genetic analysis of mtDNA and microsatellite DNA data from samples collected in the Gulf of Mexico and the western North Atlantic revealed significant genetic differentiation between these areas (Adams and Rosel 2006). In addition, the genetic data provided evidence for separation of dolphins within the western North Atlantic into two stocks with a provisional point of differentiation near Cape Hatteras, North Carolina (Adams and Rosel 2006). These two genetically differentiated groups are not yet recognized as distinct stocks pending ongoing analyses, and therefore are treated as one western North Atlantic stock for the remainder of this assessment.

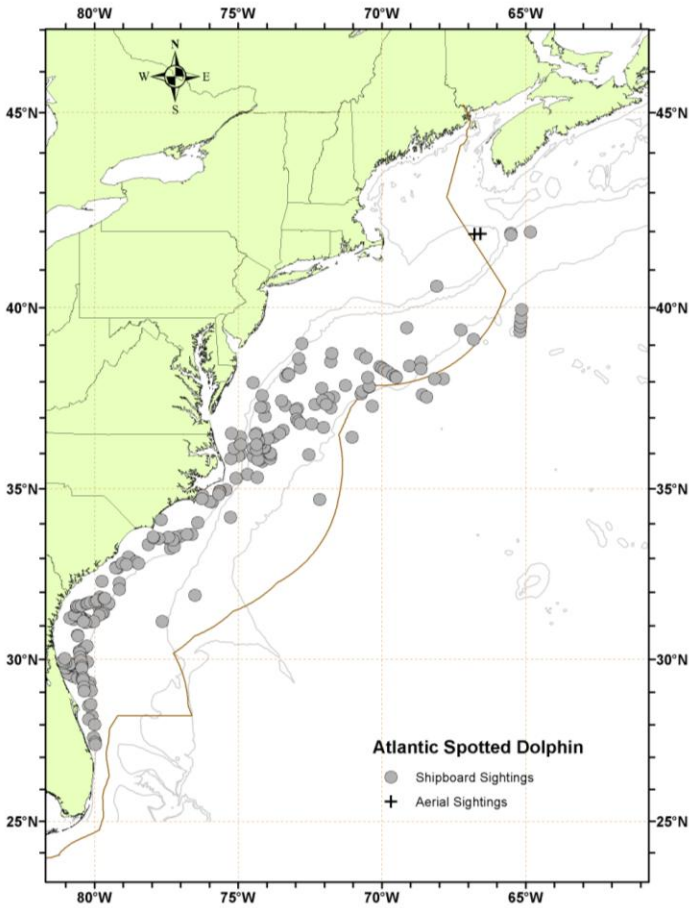

Figure 1. *Distribution of Atlantic spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, ~~and~~ 2004 and 2011. Isobaths are the ~~at~~ 100--m, 1,000--m, and 4,000--m depth contours.*

~~The western North Atlantic population is provisionally being considered a separate stock from the Gulf of Mexico stock(s) for management purposes. Adams and Rosel (2006) also provide evidence for genetic separation of dolphins within the western North Atlantic into two stocks with a provisional point of differentiation near Cape Hatteras, NC. These two Atlantic stocks, however, are not currently recognized as distinct management units, and thus will be treated as one~~

~~western North Atlantic stock for the remainder of this assessment.~~

POPULATION SIZE

The best abundance estimate available for Atlantic spotted dolphins in the western North Atlantic is 44,715 (CV=0.43; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. The two spotted dolphin species in the Atlantic can be difficult to distinguish at sea, and in fact hybrids between the two species have been documented in this area (Kingston *et al.* 2009). As a result, prior to 1999, the reported abundance estimates were of both species combined. More recent effort has shown that in the waters south of Cape Hatteras identification to species can confidently be made. Furthermore, distinction between the two Atlantic spotted dolphin ecotypes has not regularly been made during surveys, and at their November 1999 meeting, the Atlantic SRG recommended that without a genetic determination of stock structure for the two ecotypes, the abundance estimates for the coastal and offshore forms should be combined. The abundance estimate provided here is a species-specific estimate combining both ecotypes of Atlantic spotted dolphins.

~~Atlantic spotted dolphin sightings have been concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic (Fig. 1). The best recent abundance estimate for Atlantic spotted dolphins is the result of the 2011 survey – 26,798 (CV= 0.66) .~~

~~Because *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. At their November 1999 meeting, the Atlantic SRG recommended that without a genetic determination of stock structure, the abundance estimates for the coastal and offshore forms should be combined. There remains debate over how distinguishable both species are at sea, though in the waters south of Cape Hatteras identification to species is made with very high certainty. This does not, however, account for the potential for a mixed species herd, as has been recorded for several dolphin assemblages. Pending further genetic studies for clarification of this problem, a single species abundance estimate will be used as the best estimate of abundance, combining species specific data from the northern as well as southern portions of the species' ranges.~~

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

Recent surveys and abundance estimates

~~An abundance estimate of 3,578 (CV= 0.48) Atlantic spotted dolphins was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38°N) to the Bay of Fundy (45°N) (Figure 1; Palka Unpublished Ms.). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Figure 1; Palka Unpublished Ms).~~

~~A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥50 m) between 27.5 – 38 ºN latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias *g(0)* and group size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for Atlantic spotted dolphins between Florida and Maryland was 47,400 animals (CV=0.45).~~

~~An abundance estimate of 26,798 (CV= 0.66) Atlantic spotted dolphins was generated from a shipboard and aerial survey conducted during June-August 2011. The aerial portion covered 6,850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines that were in waters that were deeper than the 100-m depth contour out to beyond the US EEZ. Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for~~

~~perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).~~ An abundance estimate of 26,798 (CV=0.66) Atlantic spotted dolphins was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

~~In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.~~An abundance estimate of 17,917 (CV=0.42) Atlantic spotted dolphins was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the western North Atlantic spotted dolphins, *Stenella frontalis*, by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to the Bay of Fundy	3,578	0.48
Jun-Aug 2004	Florida to Maryland	47,400	0.45
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	50,978	0.42
Jun-Aug 2011	~~North Carolina~~central Virginia to lower Bay of Fundy	26,798	0.66
Jun-Aug 2011	central Florida to central Virginia	17,917	0.42
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	44,715	0.43

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best abundance estimate is 44,715 (CV=0.43)~~26,798 (CV= 0.66)~~. The minimum population estimates based on the 2011 abundance estimates is 31,610~~16,151~~.

Current Population Trend

~~There are insufficient data to determine the population trends for this species, because prior to 1998, species of spotted dolphins were not differentiated during surveys.~~A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless

surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Atlantic spotted dolphin is 31,610~~16,151~~. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is set to 0.5 because this stock is of unknown status. PBR for the combined offshore and coastal forms of Atlantic spotted dolphins is 316~~162~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated fishery-related mortality and serious injury to this stock during 2007-2011 was zero, as there were no reports of mortalities or serious injury to Atlantic spotted dolphins.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the two species of spotted dolphins in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury.~~Total annual estimated average fishery-related mortality or serious injury to this stock during 2006-2010 was 0.2 due to one animal in the stranding records that was struck by a boat. .~~

Earlier Interactions

No spotted dolphin mortalities were observed in 1977-1991 foreign fishing activities. Bycatch had been observed in the pelagic drift gillnet and pelagic longline fisheries, but no mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast sink gillnet, mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries. No takes have been documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Forty-nine undifferentiated spotted dolphin mortalities were observed in the drift gillnet fishery between 1989 and 1998 and occurred northeast of Cape Hatteras within the 183m isobath in February-April and near Lydonia Canyon in October. Six whole animal carcasses sent to the Smithsonian were identified as pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), no fishery in 1997 and 0 in 1998.

Pelagic Longline

There were no observed mortalities or serious injuries to spotted dolphins by this fishery in the Atlantic Ocean during 2007-2011 (Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2012a; 2012b). Between 1992 and 2006~~2005~~, 2 spotted dolphins (recorded as Atlantic spotted dolphins) were hooked and released alive in the pelagic longline fishery in the Atlantic~~+~~, including one dolphin hooked and released alive with serious

injuries in 2003 (in the mid-Atlantic Bight fishing area), and one dolphin was released alive without serious injuries in 2005 (in the Sargasso fishing area) (Garrison and Richards 2004; Fairfield-Walsh and Garrison 2006.). The estimated fishery-related mortality to Atlantic spotted dolphins in the U.S. Atlantic (excluding the Gulf of Mexico) attributable to this fishery between 2001-2005 was 6 (CV=1) ~~(Table 2)~~ (Garrison 2003, 2005; Garrison and Richards 2004; Fairfield-Walsh and Garrison 2006).

Other Mortality

~~From 2006-2010, 19~~During 2007-2011, 19 Atlantic spotted dolphins were reported stranded between New York and Florida~~Massachusetts and Puerto Rico~~ (Table 2; ~~NMFS unpublished data~~NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 (SER) and 9 November 2012 (NER)). ~~-~~One of these strandings had documented signs of ~~fishery or~~ human interactions—a Florida 2007 mortality with extensive propeller wounds.

Stranding data probably underestimate the extent of ~~fishery~~human-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other ~~fishery~~human-interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interaction.

~~Table 2. Atlantic spotted dolphin (*Stenella frontalis*) reported strandings along the U.S. Atlantic coast, 2006-2010.~~

~~STATE~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~TOTALS~~
~~New York~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~
~~New Jersey~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~
~~Virginia~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~
~~North Carolina~~	~~1~~	~~0~~	~~1~~	~~1~~	~~6~~	~~9~~
~~South Carolina~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~Georgia~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~
~~Florida[a]~~	~~0~~	~~2~~	~~0~~	~~2~~	~~0~~	~~4~~
~~Puerto Rico~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~
~~TOTALS~~	~~2~~	~~3~~	~~1~~	~~3~~	~~10~~	~~19~~

~~a. One of the 2007 Florida animals was classified as a boat strike, One of the 2009 animals live stranded and was transferred to rehab.~~

Table 2. Atlantic spotted dolphin (*Stenella frontalis*) reported strandings along the U.S. Atlantic coast, 2007-2011.

STATE	2007	2008	2009	2010	2011	TOTALS
New York	0	1	0	1	1	3
New Jersey	0	0	0	1	0	1
Virginia	0	0	0	1	0	1
North Carolina	2	1	1	6	0	10
Georgia	1	0	0	0	0	1
Florida[a]	2	0	1	0	0	3
TOTALS	5	2	2	10	1	19

[a] One of the 2007 Florida animals was classified as a boat strike.

STATUS OF STOCK

~~Average annual human-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the~~

~~calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.~~ Atlantic spotted dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the Marine Mammal Protection Act~~U.S. MMPA~~. No fishery-related mortality or serious injury has been observed during recent years; therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching the zero mortality and serious injury rate. The status of Atlantic spotted dolphins in the U.S. Atlantic EEZ relative to OSP ~~in the U.S. Atlantic EEZ~~ is unknown. There are insufficient data to determine the population trends for this species. ~~The species is not listed as threatened or endangered under the Endangered Species Act.~~

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PANTROPICAL SPOTTED DOLPHIN (*Stenella attenuata*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin *et al.* 1987; Perrin and Hohn 1994). There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin, *Stenella frontalis*, ~~formerly *S. plagiodon*,~~ and the pantropical spotted dolphin, *S. attenuata* (Perrin *et al.* 1987). The Atlantic spotted dolphin occurs in two forms which may be distinct sub-species (Perrin *et al.* 1987, Perrin and Hohn 1994; Rice 1998): the large, heavily spotted form which inhabits the continental shelf and is usually found inside or near the 200-m isobath; and the smaller, less spotted island and offshore form which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Fulling *et al.* 2003; Mullin and Fulling 2003; Mullin and Fulling 2004). Where they co-occur, the offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea.

Pantropical spotted dolphins have been seen in all seasons during winter aerial surveys offshore of the southeastern U.S. Atlantic coast and during seasonal aerial surveys of the northern Gulf of Mexico (SEFSC unpublished data). Sightings during surveys in the Atlantic have been concentrated in the slope waters north of Cape Hatteras while in waters south of Cape Hatteras sightings are recorded over the Blake Plateau and in deeper offshore waters of the mid-Atlantic (Figure 1). Sightings of pantropical spotted dolphins in the northern Gulf of Mexico occur primarily over the deeper waters, and rarely over the continental shelf or continental shelf edge (Maze-Foley and Mullin 2006~~Mullin *et al.* 1991; SEFSC, unpublished data~~). ~~Pantropical spotted dolphins were seen in all seasons during seasonal aerial surveys of the northern Gulf of Mexico, and during winter aerial surveys offshore of the southeastern U.S. Atlantic coast (SEFSC unpublished data).~~

~~Some of the Pacific populations have been divided into different geographic stocks based on morphological characteristics (Perrin 1987; Perrin and Hohn 1994).~~

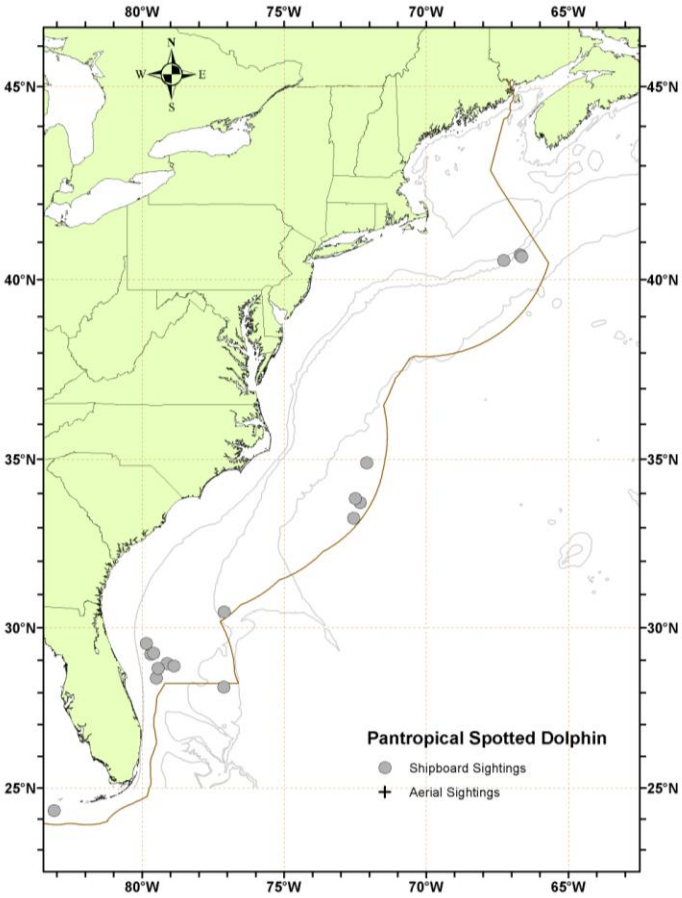

Figure 1. *Distribution of pantropical spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, ~~and~~ 2004 and 2011. Isobaths are ~~at~~ the 100 m, 1,000 m, and 4,000 m ~~isobaths~~depth contours.*

The western North Atlantic pantropical spotted dolphin population is ~~provisionally~~ being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The best abundance estimate available for western North Atlantic pantropical spotted dolphins is 3,333 (CV=0.91; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. The two spotted dolphin species in the Atlantic can be difficult to distinguish at sea, and in fact hybrids between the two species have been documented in this area (Kingston *et al.* 2009). As a result, prior to 1999, the reported abundance estimates were of both species combined. More recent effort has shown that in the waters south of Cape Hatteras identification to species can confidently be made. The abundance estimate provided here is a species-specific estimate for the pantropical spotted dolphin.

Total numbers of pPantropical spotted dolphins dolphinoff the U.S. or Canadian Atlantic coast are unknown, although estimates are available from selected regions for select time periods. Sightings sightings have been concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic (Fig. 1). The best recent abundance estimate for pantropical spotted dolphins is the sum of the estimates from the two 2004 western U.S. Atlantic surveys. This joint estimate (0+4,439=4,439) is considered best because these two surveys together have the most complete coverage of the species' habitat.

Because *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. At their November 1999 meeting, the Atlantic SRG recommended that without a genetic determination of stock structure, the abundance estimates for the coastal and offshore forms should be combined. There remains debate over how distinguishable both species are at sea, though in the waters south of Cape Hatteras identification to species is made with very high certainty. This does not, however, account for the potential for a mixed species herd, as has been recorded for several dolphin assemblages. Pending further genetic studies for clarification of this problem, a single species abundance estimate will be used as the best estimate of abundance, combining species specific data from the northern as well as southern portions of the species' ranges.

Earlier abundance estimates

Please see Appen

continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance estimate of 4,772 (CV=1.27) undifferentiated spotted dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (NMFS unpublished data). An abundance estimate of 343 (CV=1.03) pantropical spotted dolphins was derived from a line-transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N). An abundance estimate of 12,747 (CV=0.56) pantropical spotted dolphins was generated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

There were no sightings of pantropical spotted dolphins during aerial and shipboard surveys conducted during June-August 2011 from central Virginia to the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure.

An abundance estimate of 3,333 (CV=0.91) pantropical spotted dolphins was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).An abundance estimate of zero pantropical spotted dolphins was obtained from a line-

~~transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38°N) to the Bay of Fundy (45°N) (Table 1; Palka 2006), as no dolphins of this species were observed. Shipboard data were collected using the two independent independent team line-transect method and analyzed using the modified direct direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle back line line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥50 m) between 27.5 – 38 ºN latitude was conducted during June August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the Mid Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias *g(0)* and group size bias and analyzed using line transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for pantropical spotted dolphins between Florida and Maryland was 4,439 animals (CV=0.49)(Table 1).~~

Table 1. Summary of abundance estimates for the western North Atlantic pantropical spotted *dolphin (Stenella attenuata)* by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to the Bay of Fundy	0	0
Jun-Aug 2004	Florida to Maryland	4,439	0.49
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	4,439	0.49
Jun-Aug 2011	central Virginia to lower Bay of Fundy	0	0
Jun-Aug 2011	central Florida to central Virginia	3,333	0.91
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	3,333	0.91

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate.~~—~~ This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997).~~—~~ The best estimate of abundance for pantropical spotted dolphins is 3,333 (CV=0.91).~~4,439 (CV=0. 49)~~ -The minimum population estimate for pantropical spotted dolphins is 1,733~~3,010~~.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).~~There are insufficient data to determine population trends for this species, because prior to 1998 spotted dolphins were not differentiated during surveys.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock.~~–~~ For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04.~~–~~ This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life

history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for pantropical spotted dolphins is 1,733~~3,010~~. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for pantropical spotted dolphins is 17~~30~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated fishery-related mortality and serious injury to this stock during 2007-2011 was zero, as there were no reports of mortalities or serious injury to pantropical spotted dolphins.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the two species of spotted dolphins in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury~~. Total annual estimated average fishery-related mortality or serious injury to this stock during 2001-2005 was 6 (CV=1) undifferentiated spotted dolphins.~~.

Earlier Interactions

No spotted dolphin mortalities were observed in 1977-1991 foreign fishing activities. No mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast sink gillnet, Mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries. No takes have been documented in a review of Canadian gillnet and trap fisheries (Read 1994).

~~Bycatch has been observed in the pelagic longline fisheries (two dolphins hooked and released alive without serious injuries - one in the Mid-Atlantic Bight area in 1993, and one in the Gulf of Mexico in 1994) (Yeung 1999)~~ Forty-nine undifferentiated spotted dolphin mortalities were observed in the drift gillnet fishery between 1989 and 1998 and occurred northeast of Cape Hatteras within the 183 m isobath in February-April, and near Lydonia Canyon in October. Six whole animal carcasses sent to the Smithsonian were identified as pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), no fishery in 1997 and 0 in 1998.

Pelagic Longline

There were no observed mortalities or serious injuries to spotted dolphins by this fishery in the Atlantic Ocean during 2007-2011 (Fairfield and Garrison 2008; Garrison *et al*. 2009; Garrison and Stokes 2010; 2012a; 2012b). Between 1992 and 2006~~2005~~, 2 spotted dolphins (recorded as Atlantic spotted dolphins) were hooked and released alive in the Atlantic, including one dolphin hooked and released alive with serious injuries in 2003 (in the Mid-Atlantic Bight fishing area), and one dolphin was released alive without serious injuries in 2005 (in the Sargasso fishing area) (Garrison and Richards 2004; Fairfield-Walsh and Garrison 2006~~.~~). The estimated fishery-related mortality to spotted dolphins in the U.S. Atlantic (excluding the Gulf of Mexico) attributable to this fishery between 2001-2005 was 6 undifferentiated spotted dolphins (CV=1) ~~(Table 2)~~ (Garrison 2003, 2005; Garrison and Richards 2004; Fairfield-Walsh and Garrison 2006).

Table 2. Summary of the incidental mortality and serious injury of undifferentiated spotted dolphins (*Stenella frontalis* and *Stenella attenuata*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels[a]	Data Type[b]	Observer Coverage[c]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality[d]	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Pelagic Longline (excluding NED-E)[h]	01-05	98, 87, 63, 60, 60	Obs. Data Logbook	.04, .05, .09, .09, .06	0, 0, 1, 0, 0	0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 1, 0, 0	6 (1)
TOTAL											6 (1)

a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).

Other Mortality

From 2001-2005, 3 pantropical spotted dolphins were stranded between South Carolina and Florida (Table 3) (NMFS unpublished data). These include one animal stranded in Florida in both 2002 and 2003, and one animal stranded in South Carolina in 2004 as part of an Unusual Mortality Event (UME). A Mid-Atlantic Offshore Small Cetacean UME, was declared when 85 small cetaceans stranded from Maryland to Georgia between 3 July 2004 and 16 January 2005. The species involved are generally found offshore and are not expected to strand along the coast. Gross necropsies were conducted and samples were collected for pathological analyses (Hohn et al. 2006), though no single cause for the UME was determined. The authors could not "definitively conclude that there was or was not a causal link between anthropogenic sonar activity or environmental conditions (or a combination of these factors) and the strandings". Prior to this, 4 animals stranded in Florida in 1999. There were no documented signs of fishery or human interactions in any of these strandings.

There were no reported strandings of pantropical spotted dolphins in the U.S. Atlantic Ocean during 2007-2011 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). Stranding data probably underestimate the extent of fisheryhuman-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fisheryhuman- interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fisheryhuman interactions.

Table 3. Pantropical spotted dolphin (*Stenella attenuata*) reported strandings along the U.S. Atlantic coast, 2001-2005.

STATE	2001	2002	2003	2004	2005	TOTALS
South Carolina	0	0	0	1[a]	0	1
Florida	1	1	0	0	0	2

TOTALS	1	1	0	1	0	3

[a]One pantropical spotted dolphin stranded in September in South Carolina and was considered part of the North Carolina Unusual Mortality Event.

STATUS OF STOCK

Pantropical spotted dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the U.S. MMPAMarine Mammal Protection Act. No fishery-related mortality or serious injury has been observed during recent years; therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching the zero mortality and serious injury rate. The status of pantropical spotted dolphins, relative to OSP in the western U.S. Atlantic EEZ relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. Total U.S.fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual human-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock.

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ROUGH-TOOTHED DOLPHIN *(Steno bredanensis)*: Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Rough-toothed dolphins (*Steno bredanensis*) are distributed worldwide in the Atlantic, Pacific and Indian Oceans, generally in warm temperate, subtropical, or tropical waters. They are commonly reported in a wide range of water depths, from shallow, nearshore waters to oceanic waters (West *et al.* 2011). Most shipboard sightings from the U.S. East Coast have occurred in oceanic waters at depths greater than 1,000 m (Figure 1). The distribution of the rough-toothed dolphin (*Steno bredanensis*) is poorly understood worldwide. These dolphins are thought to be a tropical to warm temperate species, and historically have been reported in deep oceanic waters in the Atlantic, Pacific, and Indian oceans and the Mediterranean and Caribbean seas (Perrin and Walker 1975; Leatherwood and Reeves 1983; Reeves *et al.* 2003; Gannier and West 2005). Rough-toothed dolphins have, however, been observed in both shelf and oceanic waters in the northern Gulf of Mexico, and off Japan, Brazil, and Mauritania (Maigret *et al.* 1976; Miyazaki 1980; Lodi and Hetzel 1999; Addink and Smeenk 2001; Fulling *et al.* 2003; Mullin and Fulling 2003; Gannier and West 2005). In French Polynesia, rough-toothed dolphins were observed in deep waters, but were more commonly distributed inshore than offshore (Gannier and West 2005). Ritter (2002) observed rough-toothed dolphins in the Canary Islands in waters from 20 m to 2,500 m, with the average depth reported as 506 m and surface water temperatures ranging from 17° to 24°C. Rough-toothed dolphins have been reported feeding in waters off Brazil ranging from 5 m to 39 m in depth, with surface temperatures between 22°to 24°C (Lodi and Hetzel 1999). Sightings of rough-toothed dolphins along the East Coast of the U.S. are much less common than in the Gulf of Mexico (CETAP 1982; NMFS 1999; Mullin and Fulling 2003).

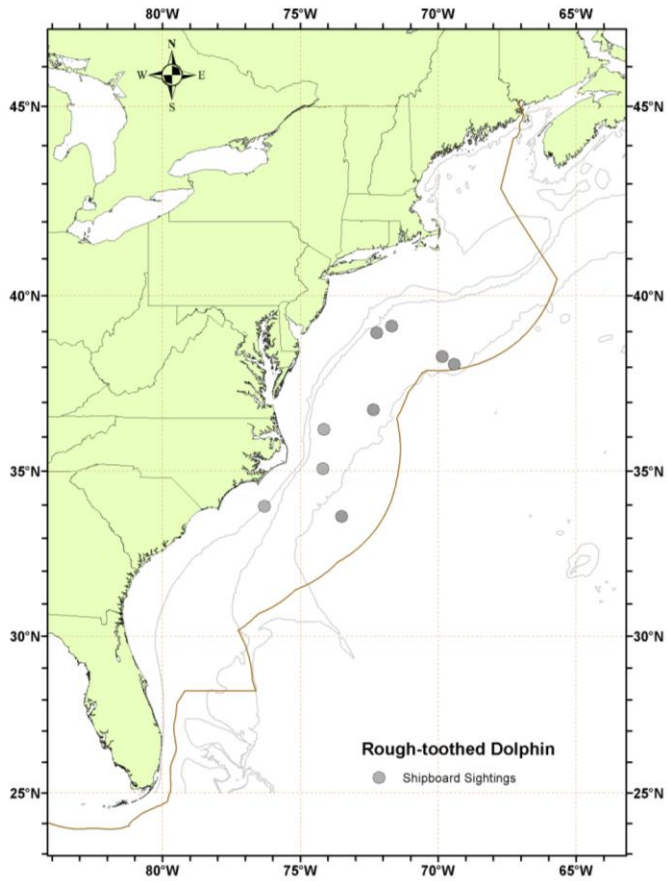

Figure 1. *Distribution of rough-toothed dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006, 2007, 2010 and 2011. Isobaths are the 100-m, 1000-m and 4000-m depth contours.* *from 1979 - 201105. Isobaths are at the 100- m, 1,000- m.*

In the western North Atlantic, tracking of five rough-toothed dolphins whichthat were rehabilitated and released following a mass stranding on the east coast of Florida in 2005, demonstrated a variety of ranging patterns (Wells *et al.* 2008In review). All tagged rough-toothed dolphins moved through a large range of water depths averaging greater than 100 m, though each of the five tagged dolphins transited through very shallow waters at some point, with most of the collective movements recorded over a gently sloping sea floor. These five rough-toothed dolphins moved through waters ranging from 17° to 31°C, with temperatures averaging 21° to 30°C. Recorded dives were rarely deeper than 50 m, with the tagged dolphins staying fairly close to the surface. Three rehabilitated rough-toothed dolphins released with tags near Ft. Pierce, Florida in March 2005 were tracked in waters averaging 1,100 m in depth with sea surface temperatures averaging 24°C during the first week of tracking, moving to waters of 19°C (Wells and Gannon 2005). Rehabilitated rough-toothed dolphins released and tracked in the northeast Gulf of

Mexico in 1998 were recorded in waters with an average depth of 195 m and an average sea surface temperature of 25°C, typically over or near an escarpment (Wells *et al.* 1999). It is not known how representative of normal species patterns any of these movements are.

~~Although Miyazaki and Perrin (1994) describe these dolphins as a "diving species," dives of more than 3 minutes duration were rare for the tagged dolphins (Wells *et al.* 1999; Wells and Gannon 2005; Wells *et al.* In review), similar to behavior reported for this species by Lodi and Hetzel (1999) and Ritter (2002).~~

~~These dolphins are typically seen in small groups of 10-20 animals (Wade and Gerrodette 1993; Jefferson 2002; Reeves *et al.* 2003; Waring *et al.* 2007) . Larger groups have been recorded, namely groups of 45 animals in the Atlantic (CETAP 1982), over 50 animals in the eastern tropical Pacific, 99 animals in the Caribbean (Swartz *et al.* 2001), 160 animals in the Mediterranean, and 300 animals off Hawaii (Miyazaki and Perrin 1994).~~

~~Tagging studies of rehabilitated and released rough-toothed dolphins, as well as field observations, indicate that social bonds between members of a group may be strong. Two rough-toothed dolphins tagged and released in the Gulf of Mexico in 1998 were observed together 157 after release (Wells *et al.* 1999). Three rough-toothed dolphins released together near Ft. Pierce, Florida in 2005 exhibited frequent social interactions including food sharing, epimeletic care-giving behavior and whistle exchanges and were seen together throughout the tracking period of at least 20 days (Wells and Gannon 2005). Similar complex social behaviors have also been reported for this species off the Canary Islands (Ritter 2002; 2007), Brazil (Lodi 1992; de Moura *et al.* 2008), and Honduras (Kuczaj II and Yeater 2007). Photo-identification techniques suggest resident populations may exist off the coast of Utila, Honduras (Kuczaj II and Yeater 2007), in the Mediterranean Sea near Sicily (Reeves *et al.* 2003), and off the Canary Islands (Ritter 2001; 2007).~~

For management purposes, rough-toothed dolphins observed off the eastern U.S. coast are ~~provisionally~~ considered a separate stock from ~~dolphins recorded~~those in the northern Gulf of Mexico, although there is currently no information to differentiate these stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The best abundance estimate available for the western North Atlantic rough-toothed dolphin is 271 (CV=1.00; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.~~The number of rough-toothed dolphins off the eastern U.S. and Canadian Atlantic coast is unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen during surveys. With one exception, sightings were exclusively over or seaward of the continental slope north of the Bahamas (Figure 1). Though abundance estimates have been calculated in some cases, given the paucity of sightings as well as limited survey effort in deep, offshore areas, an accurate abundance estimate has not been made, and therefore the population size of rough-toothed dolphins in the western North Atlantic is presently considered unknown.~~

~~Rough-toothed dolphins were seen only twice during the Cetacean and Turtle Assessment Program (CETAP) surveys conducted from 1978 to 1982 in continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). Twenty probable rough-toothed dolphins were seen from the U.S. Coast Guard cutter *Cherokee* during the CETAP Platform of Opportunity Program (POP) in June 1979. In September 1979, 45 rough-toothed dolphins were observed from the Russian R/V *Belagorsk*. No abundance estimate was made based on these two sightings.~~

~~A sighting of 9 rough-toothed dolphins was made from the R/V *Westward* in June 1986 during an opportunistic cruise (Kenney pers. comm.). In January 1992, 6 rough-toothed dolphins were reported during a SEFSC aerial survey. Three rough-toothed dolphins were observed on 5 March 1997 during an aerial survey conducted by Continental Shelf Associates (Kenney pers. comm.).~~

~~Eight rough-toothed dolphins were seen on 28 July 1998 during a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003). An abundance estimate of 274 (CV=1.03) was calculated based on this one sighting.~~

~~Three rough-toothed dolphins were observed from a ship in July 1998 during a line-transect sighting survey conducted from 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters~~

~~north of Maryland (38ºN) (Palka 2006). An abundance estimate of 30 (CV=0.86) was calculated based on this one sighting.~~

~~Two groups of rough-toothed dolphins were observed during a vessel survey of the western North Atlantic off Cape Hatteras, North Carolina in waters greater than 2,500 m deep (NMFS 1999). Four rough-toothed dolphins were seen in August 1999, and 20 rough-toothed dolphins were seen in September 1999. No abundance estimate was made based on these two sightings.~~

Recent surveys and abundance estimates

Aerial and shipboard surveys were conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. No abundance estimate was made for rough-toothed dolphins from the 2011 shipboard or aerial surveys since it was rarely sighted.

An abundance estimate of 271 (CV=1.00) rough-toothed dolphins was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. The survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

~~There have been no sightings of rough-toothed dolphins during shipboard or aerial surveys since 1999, except in the Caribbean, despite survey cruises conducted in areas where previous sightings of this species had been made. Survey effort in deep, offshore areas off the eastern U.S. coast and in the Caribbean, where this species may occur with more frequency, has, however, been limited.~~

Table 1. Summary of abundance estimates for the western North Atlantic rough-toothed dolphin, *Steno bredanensis*, by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2011	central Virginia to lower Bay of Fundy	0	0
Jun-Aug 2011	central Florida to central Virginia	271	1.00
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	271	1.00

Minimum Population Estimate

~~Present data are insufficient to calculate a minimum population estimate for this stock.~~The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log- normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best abundance estimate is 271 (CV=1.00). The minimum population estimate is 134.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the

maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 134~~unknown~~. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the western North Atlantic stock of rough-toothed dolphins is 1.3~~unknown, due to an unknown minimum population size~~.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated fishery-related mortality and serious injury to this stock during 2007-2011 was zero, as there were no reports of mortalities or serious injuries to rough-toothed dolphins.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al.* 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

~~Detailed fishery information is reported in Appendix III. No rough-toothed dolphins have been reported as bycatch in any of these fisheries (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Palka, pers. com.; Fairfield Walsh and Garrison 2007). Total annual estimated average fishery-related mortality and serious injury to this stock during 2002-2006 was zero rough-toothed dolphins, as there were no reports of mortality or serious injury to this stock.~~

Rough-toothed dolphins have been taken incidentally in the tuna purse seine nets in the eastern tropical Pacific, and in gill-nets off Sri Lanka, Brazil and the offshore North Pacific (Jefferson 2002), though no incidental takes have been reported off the eastern U.S. coast. A small number of this species are taken in directed fisheries in the Caribbean countries of St. Vincent and the Lesser Antilles, as well as in countries in the Pacific and eastern north Atlantic Oceans (Northridge 1984; Argones 2001; Jefferson 2002; Reeves *et al.* 2003).

Other Mortality

~~From 2002 to 2006, 146 rough-toothed dolphins were reported stranded between Maine and Puerto Rico~~ Although there have been several mass strandings of rough-toothed dolphins along the U.S. east coast in the past, from 2007 to 2011 no rough-toothed dolphins were reported stranded between Maine and Florida (~~Table 2~~NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012).

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.~~Human interaction was recorded for two dolphins that stranded in North Carolina in 2006, though specific details of the type of interaction were not recorded. Although rarely observed at sea in the southeastern U.S., this species accounts for 34% of the reported mass strandings involving 5 or more animals in the past 10 years. The majority of these occurred along the Atlantic coast of Florida and Georgia and the Gulf coast of Florida (NMFS 2008; Table 1).~~

~~Table 2. Rough-toothed dolphin (*Steno bredanensis*) strandings along the U.S. Atlantic coast (2002-2006).~~

STATE	2002	2003	2004	2005	2006	TOTALS
Virginia	141	0	0	0	0	14
North Carolina	0	0	0	0	2	2
Georgia	0	172	0	0	0	17
Florida	1	2	373	704	1	111
Puerto Rico	0	2	0	0	0	2
TOTALS	15	21	37	70	3	146

[1]Mass live stranding of 14 animals in Northampton, VA in July 2002.

[2]Mass live stranding of 17 animals in Glynn, GA in July 2003.

[3]Mass live stranding of 37 animals in St. Lucie, FL in August 2004.

[4]Mass live stranding of 69 animals in March 2005 in Marathon, FL.

At least thirty-six rough-toothed dolphins stranded on Hutchinson Island in St. Lucie County, Florida on 6 August 2004, and another one live-stranded on 8 August 2004. Due to severe weather, the animals were walked to chest-high water and released simultaneously. The dolphins restranded later the same evening 5.6 km to the north. Thirty dolphins were euthanized on site, and seven were taken to a rehabilitation facility. Four of the dolphins died in rehabilitation and three were released on 3 March 2005 with satellite transmitters 29 km east of Ft. Pierce, Florida. All three dolphins remained together and were last recorded off the Virginia/North Carolina coast. Two of the 37 dolphins showed signs of human interaction – one had a plastic bottle cap in its fore-stomach, while the second animal had black plastic in its fore-stomach.

On 2 March 2005, at least 69 rough-toothed dolphins mass stranded alive on the Atlantic Ocean side of Marathon Island in the Florida Keys, though additional animals may have swam away or not been recovered. Fifty-six animals (41 females and 15 males) were evaluated for rehabilitation candidacy, 10 of which died naturally and 14 were euthanized on site. The remaining 32 dolphins were transferred to three rehabilitation facilities, though 12 of these dolphins died during rehabilitation. No evidence of human or fishery interaction was reported in any of the dolphins. A review of the potential causative factors for this mass stranding suggested that a transient environmental change, specifically a rapid change in near-shore water temperatures associated with a shift in wind direction, led an already nutritionally deficient group of dolphins into shallow water (NMFS 2008). Once in this habitat, the dolphins were presumably unable to navigate their way back out, resulting in the stranding. There was no indication of significant health effects due to toxins associated with harmful algal blooms, there was no evidence of acoustic trauma and only very limited potential exposure to Naval active acoustic activity, nor was there any evidence that an infectious agent such as a parasite, bacteria, or virus resulted in significant health effects and contributed to the stranding event

Eleven rehabilitated dolphins from this stranding were tagged and released back into the Atlantic Ocean in continental slope waters, two on 20 April 2005 off Key Biscayne, Florida; seven on 3 May 2005 and two on 12 September 2005 off Key Largo, Florida. Ten dolphins were tagged with VHF or satellite-linked transmitters and were tracked for 12-49 days (Wells *et al.* In review). For the two releases involving multiple tagged dolphins, the individuals appeared to remain together through much, if not all, of the tracks (Lodi 1992; Miyazaki and Perrin 1994; Lodi and Hetzel 1999; Wells and Gannon 2005). Detailed information on this mass stranding is available in National Marine Fisheries Service (2008) and in the companion report on follow-up tracking (Wells *et al.* In review).

A potential human-caused source that may contribute to mortality for this species is from pPersistent organic pollutants (POPs) are a potential source of human-caused mortality., whichThese contaminants were analyzed in 15 stranded rough-toothed dolphins from the Gulf of Mexico (Struntz *et al.* 2004). Although these dolphins exhibited lower concentrations of polychlorinated biphenyls (PCBs) than those observed in other species of dolphins including Risso's, striped and bottlenose dolphins sampled in Japan, the Mediterranean and the Gulf coast of Texas, respectively, the concentrations were above the toxic threshold for marine mammal blubber suggested by Kannan *et al.* 2000. Struntz *et al*. (2004) concluded it was "likely that PCBs pose a health risk for the population represented by

this limited sample group." Plastic debris may also pose a threat to this, and other, species, as evidenced by ~~a~~ plastic bags found in the stomachs of two stranded rough-toothed dolphins – one which stranded in 2004 in St. Lucie County Florida ~~(see above)~~, and one in northeastern Brazil (de Meirelles and Barros 2007), and a plastic bottle cap found in one of the dolphins which stranded in St. Lucie County, Florida in 2004 ~~(see above)~~.

~~Stranding data probably underestimate the extent of fishery related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.~~

STATUS OF STOCK

Rough-toothed dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the ~~U.S. MMPA~~Marine Mammal Protection Act. No fishery-related mortality or serious injury has been observed; therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching the zero mortality and serious injury rate. The status of rough-toothed dolphins in the U.S. EEZ relative to OSP is unknown. There are insufficient data to determine population trends for this stock.~~The status of rough-toothed dolphins relative to OSP in the U.S. Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population size or trends and PBR cannot be calculated for this stock. No fishery-related mortality and serious injury has been observed; therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching zero mortality. This is not a strategic stock.~~

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April 2013
~~October 2007~~

CLYMENE DOLPHIN (*Stenella clymene*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Clymene dolphin is endemic to tropical and sub-tropical waters of the Atlantic (Jefferson and Curry 2003). Clymene dolphins have been commonly sighted in the Gulf of Mexico since 1990 (Mullin *et al.* 1994; Fertl *et al.* 2003), and a Gulf of Mexico stock has been designated since 1995. ~~—~~Four Clymene dolphin groups were sighted during summer 1998 in the western North Atlantic (Mullin and Fulling 2003), and two groups were sighted in the same general area during a 1999 bottlenose dolphin survey (NMFS 1999~~unpublished~~). Two groups of Clymene dolphins were sighted during summer 2011 in the western North Atlantic, with one group in the same general area off North Carolina as the 1998 and 1999 sightings, and the other group off Florida over the Blake Plateau (NMFS unpublished data). ~~—~~These sightings and stranding records (Fertl *et al.* 2003) indicate that this species routinely occurs in the western North Atlantic. ~~—~~The western North Atlantic population is ~~provisionally~~ being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). ~~—~~Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

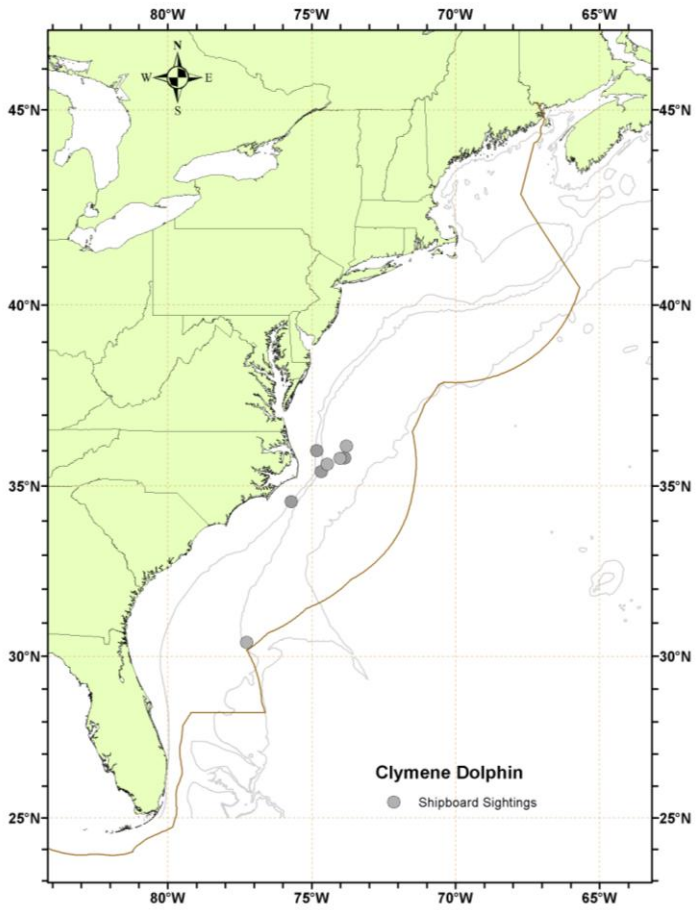

Figure 1. *Distribution of Clymene dolphin sightings from NEFSC and SEFSC vessel ~~and aerial~~ summer surveys during 1998, 1999 and 2011. Isobaths are the ~~at~~ 100-~~-~~m, 1,000-~~-~~m and 4,000-~~-~~ m depth contours.*

POPULATION SIZE

The number~~s~~ of Clymene dolphins off the U.S. ~~or Canadian~~ Atlantic coast ~~are~~is unknown~~, and seasonal abundance estimates are not available for this species since it was rarely seen in any surveys~~. ~~-~~Sightings of this species have not occurred or have been rare during any given survey, and hence only 1 abundance estimate has ever been made for U.S. Atlantic waters.

~~Clymene dolphins were observed during earlier surveys along the U.S. Atlantic coast.~~ An ~~E~~estimate~~s~~ of abundance ~~were~~was derived through the application of distance sampling analysis (Buckland *et al.* 2001) and the computer program ~~DISTANCE~~~~Distance~~ Distance (Thomas *et al.* 1998) to sighting data from a 1998 survey along the U.S. Atlantic coast. ~~-~~Data were collected using standard line-transect techniques conducted from NOAA Ship *Relentless* during July and August 1998 between Maryland (38.00°N) and central Florida (28.00°N) from the 10 m isobath to the seaward boundary of the U.S. EEZ. ~~-~~Transect lines were placed perpendicular to bathymetry in a double saw-tooth pattern. ~~—~~Sightings of Clymene dolphins were primarily on the continental slope east of Cape Hatteras, North Carolina (Figure~~.~~ 1). ~~-~~The best estimate of abundance for the Clymene dolphin was 6,086 (CV=0.93) (Mullin and Fulling 2003) and represents

the first and only estimate to date for this species in the U.S. Atlantic EEZ. ~~No Clymene dolphins have been observed in subsequent surveys.~~ However, ~~A~~as recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, and therefore should not be used for PBR determinations.

Minimum Population Estimate

~~No minimum population estimate is available at this time.~~Present data are insufficient to calculate a minimum population estimate for the western North Atlantic stock of Clymene dolphins.

Current Population Trend

There are insufficient data to determine population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one half the maximum net productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown; therefore, PBR for the western North Atlantic Clymene dolphin stock is undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated fishery-related mortality and serious injury to this stock during 2007-2011 was zero, as there were no reports of mortalities or serious injury to Clymene dolphins.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III.

~~Total annual estimated fishery-related mortality and serious injury to this stock during 2001-2005 was zero, as there were no reports of mortalities or serious injury to Clymene dolphins.~~

Other Mortality

There were 2 reported strandings of Clymene dolphins in the U.S. Atlantic Ocean during 2007-2011 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 (SER) and 9 November 2012 (NER)). ~~There has been one reported stranding of a Clymene dolphin in the western North Atlantic between 2001-2005, which occurred in NC in August 2004. This stranding was part of the Mid-Atlantic Offshore Small Cetacean UME, which was declared when 33 small cetaceans stranded from Maryland to Georgia between July-September 2004. One Clymene dolphin was involved in this UME.~~ Two animals mass stranded off Maryland during October 2011. It could not be determined if there were signs of human interactions.

~~Prior to this, one stranding of a Clymene dolphin was recorded in Florida in 1999. No sign of fishery or human interactions were noted.~~ There may be some uncertainty in the identification of this species due to similarities with other *Stenella* species.

Stranding data probably underestimate the extent of ~~fishery~~human-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other ~~fishery~~human~~-~~ interactions. ~~-~~Finally, the level of technical

expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interactions.

STATUS OF STOCK

Clymene dolphins are not listed as threatened or endangered under the Endangered Species Act, and the Western North Atlantic stock is not considered strategic under the ~~U.S. MMPA~~Marine Mammal Protection Act. No fishery-related mortality or serious injury has been observed; therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching the zero mortality and serious injury rate. The status of Clymene dolphins in the U.S. EEZ relative to OSP is unknown. There are insufficient data to determine population trends for this stock.~~The status of Clymene dolphins, relative to OSP, in the EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. Because there are insufficient data to calculate PBR it is not possible to determine if stock is strategic and if the total U.S. fishery-related mortality and serious injury for this stock is significant and approaching zero mortality and serious injury rate. However, because there are no documented takes in U.S. waters, this stock has been designated as not strategic.~~

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April 2013
~~October 2007~~

SPINNER DOLPHIN (*Stenella longirostris longirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Spinner dolphins are distributed in oceanic and coastal tropical waters (Leatherwood *et al.* 1976). This is presumably an offshore, deep-water species (Schmidly 1981; Perrin and Gilpatrick 1994), and its distribution in the Atlantic is very poorly known. In the western North Atlantic, these dolphins occur in deep water along most of the U.S. coast south to the West Indies and Venezuela, including the Gulf of Mexico. Spinner dolphin sightings have occurred almost exclusively in deeper (>2,000 m) oceanic waters (CETAP 1982; Waring *et al.* 1992; NMFS unpublished data) off the northeast U.S. coast, but there was one recent sighting during summer 2011 in oceanic waters off North Carolina (Figure 1). -Stranding records exist from North Carolina, South Carolina, Florida and Puerto Rico in the Atlantic, and in Texas, Alabama and Florida in the Gulf of Mexico. The western North Atlantic population is ~~provisionally~~ being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s) or the Puerto Rico and U.S. Virgin Islands stock~~(s)~~. Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

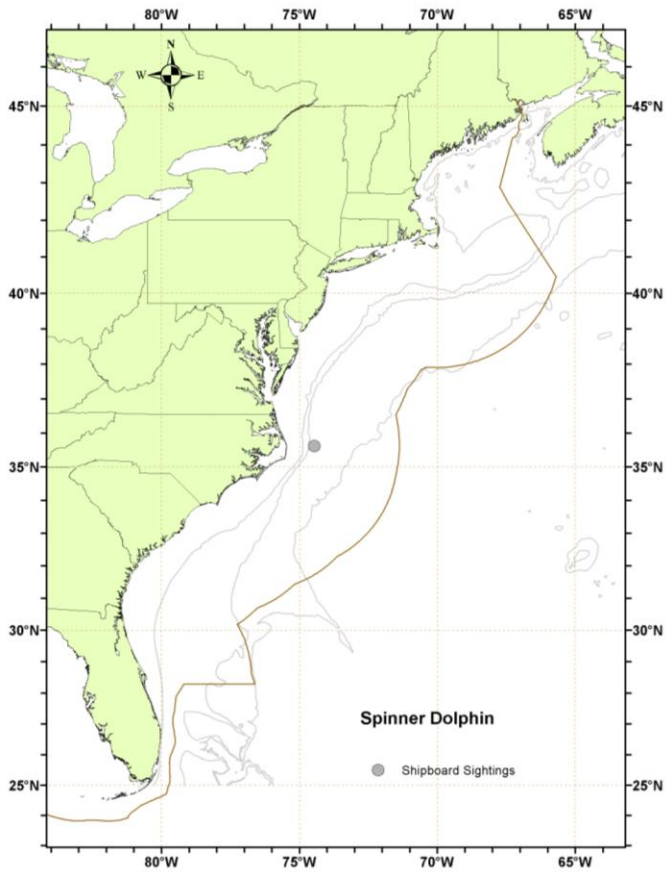

Figure 1. *Location of a spinner dolphin sighting from an SEFSC shipboard survey during summer 2011. Isobaths are ~~at~~ the 100-m, 1,000-m and 4,000-m depth contours.*

POPULATION SIZE

The numbers of spinner dolphins off the U.S. ~~or Canadian~~ Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock since it was rarely seen in any of the surveys.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status, relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the western North Atlantic spinner dolphin is unknown because the minimum population size is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to this stock during ~~2001-2005~~2007-2011 was zero, as there were no reports of mortalities or serious injury to spinner dolphins.

~~EARLIER INTERACTIONS~~Earlier Interactions

There was no documentation of spinner dolphin mortality or serious injury in distant-water fleet ~~(DWF)~~ activities off the northeast U.S. coast (Waring *et al.* 1990). No takes were documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Bycatch has been observed in the now prohibited pelagic drift gillnet fishery, and in the pelagic longline fishery (one dolphin hooked and released alive without serious injury in 1997) but no mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast sink gillnet, Mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries (Yeung 1999).

~~Pelagic Drift Gillnet~~

~~One spinner dolphin mortality was observed in the pelagic driftnet between 1989 and 1993 and occurred east of Cape Hatteras in March 1993 (Northridge 1996). Estimates of total annual bycatch for 1994 and 1995 were estimated from the sum of the observed caught and the product of the average bycatch per haul and the number of unobserved hauls as recorded in self-reported fisheries information. Variances were estimated using bootstrap re- sampling techniques. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 0.7 in 1989 (1. 00), 1.7 in 1990 (1.00), 0.7 in 1991 (1.00), 1.4 in 1992 (0.31), 0.5 in 1993 (1.00) and zero from 1994-1996. This fishery is no longer in operation.~~

Other Mortality

From ~~2001-2005~~2007-2011, ~~10~~2 spinner dolphins were reported stranded between Maine and Florida~~Puerto Rico~~ (~~Table 1~~NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). Both animals stranded in Florida during 2008. No evidence of human interaction~~s~~ was present for 1 animal, but the other animal had propeller wounds from a boat strike. It is possible the boat strike was post-mortem.~~The total includes 2 animals stranded in North Carolina in 2001, 2 animals stranded in Puerto Rico in 2002, 4 mass stranded live animals in December 2003 in Flagler, Florida (all died on the scene), 1 animal stranded in Florida 2003and in 2004. There were no indications of fishery or human interactions for these stranded animals.~~

Stranding data probably underestimate the extent of ~~fishery~~human-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other ~~fishery~~ human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interactions.

Table 1. Spinner dolphin (*Stenella longirostris*) strandings along the U.S. Atlantic coast, 2001-2005.						
STATE	**2001**	**2002**	**2003**	**2004**	**2005**	**TOTALS**
North Carolina	2	0	0	0	0	2
South Carolina	0	0	0	0	0	0
Georgia	0	0	0	0	0	0
Florida	0	0	5[a]	1	0	6
Puerto Rico	0	2	0	0	0	2
TOTALS	2	2	5	1	0	10
[a]Includes live mass stranding of 4 animals in Flagler, FL in December 2003.						

STATUS OF STOCK

Spinner dolphins are not listed as threatened or endangered under the Endangered Species Act, and the western North Atlantic stock is not considered strategic under the U.S. MMPAMarine Mammal Protection Act. No fishery-related mortality or serious injury has been observed in recent years; therefore, total fishery-related mortality and serious injury can be considered insignificant and approaching the zero mortality and serious injury rate. The status of spinner dolphins in the U.S. western North Atlantic EEZ relative to OSP is unknown. There are insufficient data to determine the population trends for this species.The status of spinner dolphins, relative to OSP, in the U.S. western North Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population size or trends and PBR cannot be calculated for this stock. No fishery-related mortality and serious injury has been observed since 1999; therefore, total fishery-related mortality and serious injury rate can be considered insignificant and approaching zero mortality and serious injury. This is not a strategic stock.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Western North Atlantic Offshore Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two morphologically and genetically distinct common bottlenose dolphin morphotypes (Duffield *et al.* 1983; Duffield 1986; Mead and Potter 1995; Rosel *et al.* 2009) described as the coastal and offshore forms. Both inhabit waters in the western North Atlantic Ocean (Hersh and Duffield 1990; Mead and Potter 1995; Curry and Smith 1997; Rosel *et al.* 2009) along the U.S. Atlantic coast. The two morphotypes are genetically distinct based upon both mitochondrial and nuclear markers (Hoelzel *et al.* 1998; Rosel *et al.* 2009). The offshore form is distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic Ocean from Georges Bank (Figure 1; CETAP 1982; Kenney 1990) to ~~Dolphins with characteristics of the offshore type have stranded as far south as~~ the Florida Keys~~.~~; where dolphins with characteristics of the offshore type have stranded. ~~however~~ However, bottlenose dolphins have occasionally been sighted ~~I~~in Canadian waters, ~~bottlenose dolphins have occasionally been sighted~~ on the Scotian Shelf, particularly in the Gully (Gowans and Whitehead 1995; NMFS unpublished data~~).~~), and these animals are thought to be of the offshore form. ~~the offshore morphotype has been documented to occur relatively close to shore over the continental shelf south of Cape Hatteras, NC.~~

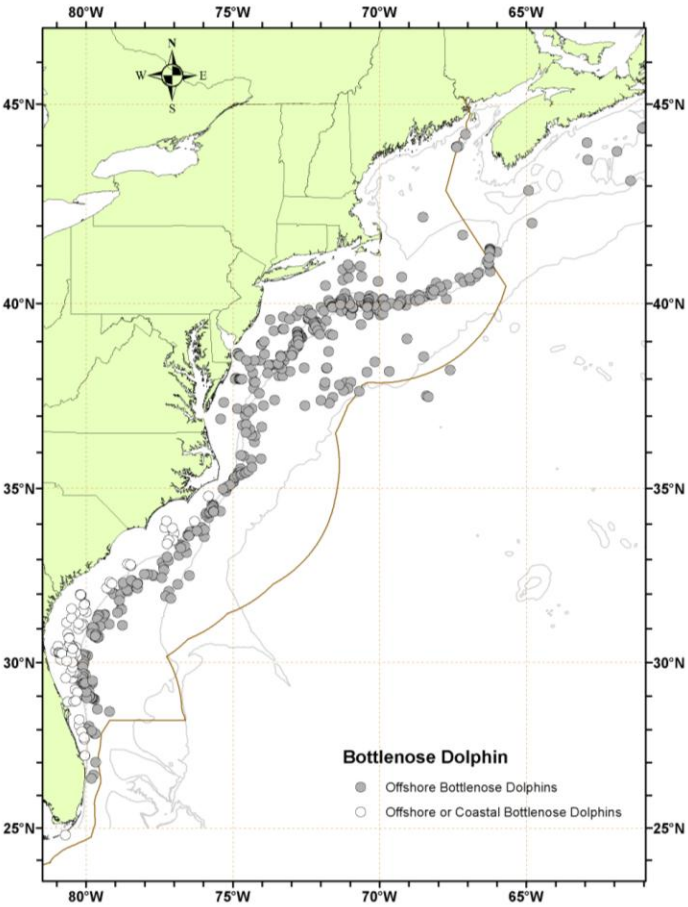

Figure 1. *Distribution of bottlenose dolphin sightings from NEFSC and SEFSC aerial surveys during summer in 1998, 1999, 2002, 2004, ~~and~~ 2006 and 2011. Isobaths are the~~at~~ 100~~-~~m, 1,000~~-~~m, and 4,000~~-~~m*

North of Cape Hatteras, there is separation of the two morphotypes across bathymetry during summer months. Aerial surveys flown during 1979-1981 indicated a concentration of bottlenose dolphins in waters < 25 m deep corresponding to the coastal morphotype, and an area of high abundance along the shelf break corresponding to the offshore stock (CETAP 1982; Kenney 1990). Biopsy tissue sampling and genetic analysis demonstrated that bottlenose dolphins concentrated close to shore were of the coastal morphotype, while those in waters > 40 m depth were from the offshore morphotype (Garrison *et al.* 2003). However, during winter months south of Cape Hatteras, North Carolina, the ranges of the coastal and offshore morphotypes overlap to some degree. Torres *et al.* (2003) found a statistically significant break in the distribution of the morphotypes at 34 km from shore based upon the genetic analysis of tissue samples collected in nearshore and offshore waters. The offshore morphotype was found exclusively seaward of 34 km and in waters deeper than 34 m. Within 7.5 km of shore, all animals were of the coastal morphotype. More recently, offshore morphotype animals have been sampled as close as 7.3 km from shore in water depths of 13 m (Garrison *et al.* 2003). Systematic biopsy collection surveys were conducted coastwide during the summer and winter between 2001 and 2005 to evaluate the degree of spatial overlap between the two morphotypes. Over the continental shelf south of

Cape Hatteras, North Carolina, the two morphotypes overlap spatially, and the probability of a sampled group being from the offshore morphotype increased with increasing depth based upon a logistic regression analysis (Garrison *et al*. 2003). -In southeastern Florida, Hersh and Duffield (1990) examined bottlenose dolphins that stranded along the southeast coast of Florida and found 4four that had hemoglobin profiles matching that of the offshore morphotype. These strandings occurred in areas with access to deep oceanic waters, suggest~~ing~~ the offshore form occurs as far south as southern Florida.Bottlenose dolphins which stranded alive in the western North Atlantic in areas with direct access to deep oceanic waters had hemoglobin profiles that matched that of the offshore morphotype (Hersh and Duffield 1990). Hersh and Duffield (1990) also described morphological differences between offshore morphotype dolphins and dolphins with hematological profiles matching the coastal morphotype which had stranded in the Indian/Banana River in Florida. North of Cape Hatteras, there is separation of the two morphotypes across bathymetry during summer months. Aerial surveys flown during 1979-1981 indicated a concentration of bottlenose dolphins in waters < 25 m deep corresponding to the coastal morphotype, and an area of high abundance along the shelf-break corresponding to the offshore stock (CETAP 1982; Kenney 1990). Biopsy tissue sampling and genetic analysis demonstrated that bottlenose dolphins concentrated close to shore were of the coastal morphotype, while those in waters > 40 m depth were from the offshore morphotype (Garrison *et al*. 2003). However, during winter months and south of Cape Hatteras, N~~orth~~ C~~arolina,~~ the range of the coastal and offshore morphotypes overlap to some degree. Torres *et al*. (2003) found a statistically significant break in the distribution of the morphotypes at 34 km from shore based upon the genetic analysis of tissue samples collected in nearshore and offshore waters. The offshore morphotype was found exclusively seaward of 34 km and in waters deeper than 34 m. Within 7.5 km of shore, all animals were of the coastal morphotype. More recently, offshore morphotype animals have been sampled as close as 7.3 km from shore in water depths of 13 m (Garrison *et al*. 2003). Systematic biopsy collection surveys were conducted coastwide during the summer and winter between 2001and 2005 to evaluate the degree of spatial overlap between the two morphotypes. Over the continental shelf south of Cape Hatteras, North Carolina the two morphotypes overlap spatially, and the probability of a sampled group being from the offshore morphotype increased with increasing depth based upon a logistic regression analysis (Garrison *et al*. 2003).
Seasonally, bottlenose dolphins occur over the outer continental shelf and inner slope as far north as Georges Bank (Figure 1; CETAP 1982; Kenney 1990). Sightings occurred along the continental shelf break from Georges Bank to Cape Hatteras during spring and summer (CETAP 1982; Kenney 1990). In Canadian waters, bottlenose dolphins have occasionally been sighted on the Scotian Shelf, particularly in the Gully (Gowans and Whitehead 1995; NMFS unpublished data). The range of the offshore bottlenose dolphin includes waters beyond the continental slope (Kenney 1990), and offshore bottlenose dolphins may move between the Gulf of Mexico and the Atlantic (Wells *et al*. 1999).

The western North Atlantic Offshore Stock of bottlenose dolphins is being considered separate from the Gulf of Mexico Oceanic Stock of bottlenose dolphins for management purposes. One line of evidence to support this decision comes from Baron *et al.* (2008), who found that Gulf of Mexico bottlenose dolphin whistles (collected from oceanic waters) were significantly different from those in the western North Atlantic Ocean (collected from continental shelf and oceanic waters) in duration, number of inflection points and number of steps.Dolphins with characteristics of the offshore type have stranded as far south as the Florida Keys.

POPULATION SIZE

The best available estimate for the offshore morphotypestock of bottlenose dolphins in the western North Atlantic is 77,532 (CV=0.40; Table 1). This estimate is from summer 2011 surveys covering waters from central Florida to the lower Bay of Fundy. -the sum of the estimates from the June-July 2002 aerial survey covering the continental shelf, the summer 2004 vessel survey south of Maryland, and the summer 2004 vessel and aircraft surveys north of Maryland. This joint estimate provides complete coverage of the offshore habitat from central Florida to Canada during summer months. The combined abundance estimate from these surveys is 81,588 (CV=0.17).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. An abundance of 16,689 (CV=0.32) bottlenose dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998, by a ship and plane that surveyed 15,900 km of trackline in waters north of Maryland (38°N) (Figure 1; Palka, unpublished). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and *g(0)*, the probability of detecting a group

~~on the track line. Aerial data were not corrected for *g(0)*. An abundance of 13,085 (CV=0.40) for bottlenose dolphins was obtained from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38˚N) (Fig. 1; Mullin and Fulling 2003). Abundance estimates were made using the program DISTANCE~~Distance ~~(Buckland *et al.* 2001; Thomas *et al.* 1998) where school size bias and ship attraction were accounted for.~~

~~**Recent surveys and abundance estimates**~~

~~During the summer (June – July) of 2002, aerial surveys covering a total of 6,734 km of trackline were conducted along the U.S. Atlantic coast between Ft. Pierce, Florida and Sandy Hook, New Jersey. The abundance of bottlenose dolphins in survey strata was obtained using line-transect methods and distance analysis, and the direct duplicate estimator was used to account for visibility bias (Buckland *et al.* 2001; Palka 1995). These estimates were further partitioned between the coastal and offshore morphotypes based upon the results of the logistic regression models and spatial analyses described above. A parametric bootstrap approach was used to incorporate the uncertainty in the logistic regression models into the overall uncertainty in the abundance estimate for offshore bottlenose dolphins (Garrison *et al.* 2003). The resulting coastwide abundance estimate for the offshore morphotype in waters < 40 m depth was 26,849 (CV=0.193).~~

~~An abundance of 9,786 (CV=0.56) for offshore morphotype bottlenose dolphins was estimated from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of 38˚N (Table 1; Palka 2005). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).~~

~~An estimate of abundance obtained from an aerial survey conducted in August 2002 was 5,100 (CV=0.41) offshore morphotype bottlenose dolphins and an abundance estimate of 2,989 (CV=1.11) was obtained from a survey conducted in August 2006. The 2002, 2006 and part of the above 2004 sighting surveys were conducted on the NOAA Twin Otter using the circle-back data collection methods, which allow the estimation of *g(0)* (Palka 2005). The estimate of *g(0)* was derived from the pooled data from the three aerial surveys, while the density estimates were year-specific. The 2006 survey covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. The 2002 survey covered 7,465 km of trackline waters from the 1000-m depth contour on the southern edge of Georges Bank to Maine; while the Bay of Fundy and Scotian shelf south of Nova Scotia was not surveyed. The 2004 survey covered 6,180 km of trackline in the region from the 100-m depth contour on the southern edge of Georges Bank to the lower Bay of Fundy; while the Scotian shelf south of Nova Scotia was not surveyed.~~

~~A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50 m) between 27.5 and 38ºN latitude was conducted during June-August 2004. The survey employed two independent visual teams searching with "bigeye" binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and there were a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were analyzed to correct for visibility bias (*g(0)*) and group size bias employing line transect distance analysis and the direct duplicate estimator (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for offshore morphotype bottlenose dolphins between Florida and Maryland was 44,953 (CV=0.26).~~

Recent surveys and abundance estimates

An abundance estimate of 2,989 (CV=1.11) bottlenose dolphins was generated from an aerial survey conducted in August 2006, which surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; NMFS 2006). The survey was conducted on the NOAA Twin Otter using the circle-back data collection methods, which allow the estimation of *g(0)* (Palka 2005).

An abundance estimate of 26,766 (CV=0.52) offshore bottlenose dolphins was generated from aerial and shipboard surveys conducted during June-August 2011 between central Virginia and the lower Bay of Fundy. The aerial portion covered 6,850 km of tracklines over waters north of New Jersey between the coastline and the 100-m

depth contour through the U.S. and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines between central Virginia and Massachusetts in waters deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a double-platform data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

An abundance estimate of 50,766 (CV=0.55) offshore bottlenose dolphins was generated from a shipboard survey conducted concurrently (June-August 2011) in waters between central Virginia and central Florida. This shipboard survey included shelf-break and inner continental slope waters deeper than the 50-m depth contour within the U.S. EEZ. The survey employed two independent visual teams searching with 25x bigeye binoculars. A total of 4,445 km of tracklines were surveyed, yielding 290 cetacean sightings. The majority of sightings occurred along the continental shelf break with generally lower sighting rates over the continental slope. Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for western North Atlantic offshore stock of bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
~~Jun-Jul 2002~~	~~New Jersey to Florida~~	~~26,849~~	~~0.19~~
~~Aug 2002~~	~~S. Gulf of Maine to Maine~~	~~5,100~~	~~0.41~~
Jun-Aug 2004	Maryland to Bay of Fundy	9,786	0.56
Jun-Aug 2004	Florida to Maryland	44,953	0.26
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	2,989	1.11
Jun-Aug 2011	central Virginia to lower Bay of Fundy	26,766	0.52
Jun-Aug 2011	central Florida to central Virginia	50,766	0.55
Jun-Aug 2011	central Florida to lower Bay of Fundy (COMBINED)	77,532	0.40

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best abundance estimate is 77,532 (CV=0.40). The minimum population estimate for western North Atlantic offshore bottlenose dolphin is 56,053~~70,775~~.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).~~The data are insufficient to determine population trends. Previous estimates cannot be utlized to assess trends~~

~~because previous survey coverage of the species' habitat was incomplete.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al*. 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for offshore bottlenose dolphins is 56,053~~70,775~~. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5~~0.4~~ because this stock is of unknown status~~ and due to the high degree of uncertainty in bycatch estimates (CV can not be calculated)~~. PBR for the western North Atlantic offshore bottlenose dolphin is therefore 561~~566~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual human-caused mortality and serious injury of offshore bottlenose dolphins ~~is unknown~~ was 41.7 (CV=0.26; Table 2) due to interactions with the Northeast bottom trawl, mid-Atlantic bottom trawl, and pelagic longline fisheries.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries that could potentially interact with this stock in the Atlantic Ocean are the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline; mid-Atlantic gillnet; and Northeast sink gillnet fisheries; the Category II mid-Atlantic bottom trawl and Northeast bottom trawl fisheries; and the Category III Gulf of Maine, U.S. mid-Atlantic tuna, shark, swordfish hook and line/harpoon fishery. ~~Total estimated mean annual fishery related mortality for this stock during 2001-2006 is unknown, however mortalities of offshore bottlenose dolphins were observed during this period in the Northeast Sink Gillnet and mid-Atlantic Gillnet commercial fisheries.~~ Detailed fishery information is reported in Appendix III.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet ~~(DWF)~~ activities off the northeast coast of the U.S. A fishery observer program, which has collected fishery data and information on incidental bycatch of marine mammals, was established in 1977 with the implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA).

Bottlenose dolphin mortalities were observed in the pelagic drift gillnet fishery in 1989-1998. Bycatch mortality estimates extrapolated for each year (CV in parentheses) were 72 in 1989 (0.18), 115 in 1990 (0.18), 26 in 1991 (0.15), 28 in 1992 (0.10), 22 in 1993 (0.13), 14 in 1994 (0.04), 5 in 1995 (0), 0 in 1996, and 3 in 1998 (0).

Thirty-two bottlenose dolphin mortalities were observed in the pelagic pair trawl fishery between 1991 and 1995. Estimated annual fishery-related mortality (CV in parentheses) was 13 dolphins in 1991 (0.52), 73 in 1992 (0.49), 85 in 1993 (0.41), 4 in 1994 (0.40) and 17 in 1995 (0.26).

Although there were reports of bottlenose dolphin mortalities in the foreign squid mackerel butterfish fishery during 1977-1988, there were no fishery-related mortalities of bottlenose dolphins reported in the self-reported fisheries information from the mackerel trawl fishery during 1990-1992.

One bottlenose dolphin mortality was documented in the North Atlantic bottom trawl in 1991 and the total estimated mortality in this fishery in 1991 was 91 (CV=0.97). Since 1992 there were no bottlenose dolphin mortalities observed in this fishery.

Pelagic Longline

The pelagic longline fishery operates in the U.S. Atlantic (including Caribbean) and Gulf of Mexico EEZ ~~(SEFSC unpublished data)~~. During 2007-2011, one serious injury of a bottlenose dolphin was observed during quarter 4 of 2009 and estimated serious injuries attributable to the pelagic longline fishery in the Mid-Atlantic Bight (MAB) region during quarter 4 were 8.5 (CV=1.00; Garrison and Stokes 2010; see also Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2012a, 2012b). The annual average serious injury and mortality attributable to the Atlantic Ocean pelagic longline fishery for the 5-year period from 2007 to 2011 was 1.7 animals (CV=1.0; Table 2). During 2009 (1 animal), 2010 (1 animal) and 2011 (2 animals), bottlenose dolphins were observed entangled and released alive in the South Atlantic Bight (SAB) and MAB regions (Garrison and Stokes 2010, 2012a, 2012b). The animals were presumed to have no serious injuries. No bottlenose dolphin mortalities or serious injuries were observed between 2002 and 2006 (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield- Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007).~~Between 1992 and 2006 in Atlantic waters, one bottlenose dolphin was observed caught and released alive during 1993, and one was caught and released alive during 1998. In addition,~~ However, one bottlenose dolphin was observed ~~taken~~entangled and released alive, presumed to have no serious injuries, in 2005 in the SAB region~~ near the continental shelf break south of Cape Hatteras, NC~~. ~~No bottlenose dolphin mortalities or serious injuries were observed between 2002 and 2006 (Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield-Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007).~~

Table 2. Summary of the incidental mortality and serious injury of Atlantic Ocean offshore bottlenose dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels[a]	Data Type[b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Northeast Bottom Trawl[c]	07-11	325,297, 277,264, 226	Obs. Data Logbook	.06, .08, .09, .16, .26	0,0,0,0,0	0,0,4,1,0	0,0,0,0,0	48,19, 18,4,10	48,19, 18,4,10	.95,.88, .92,.53, .84	20 (.52)
Mid-Atlantic Bottom Trawl[c]	07-11	386,374, 358,345, 325	Obs. Data Logbook	.03, .03, .05, .06, .08	0,0,0,0,0	0,0,1,5,2	0,0,0,0,0	11,16, 21,20,34	11,16, 21,20,34	.42,.36, .45,.34, .31	20 (.17)
Pelagic Longline	07-11	74,78, 75,79, 83	Obs. Data Logbook	.07, .07, .10, .08, .09	0,0,1,0,0	0,0,0,0,0	0,0,8.5,0,0	0,0,0,0,0	0,0,8.5,0,0	NA, NA, 1.00, NA, NA	1.7 (1.0)
TOTAL											41.7 (.26)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook and vessel trip reports in the Northeast and Mid-atlantic bottom trawl fisheries.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).
[c] Fishery related bycatch rates were estimated using a stratified ratio-estimator, pooling observer data over the five year time period (2007-2011). Pooled stratified bycatch rates were applied to annual fishing effort data resulting in annual mortality estimates across the time period.

Northeast Bottom Trawl

During 2007-2011, 5 mortalities were observed in the Northeast bottom trawl fishery. No takes were observed in 2007, 2008 and 2011; 4 mortalities were observed in 2009, and 1 mortality in 2010. New serious injury criteria were applied to all observed interactions retroactive back to 2007. There were no observed serious injuries of bottlenose dolphins in the Northeast region. Estimated annual fishery-related mortalities (CV in parentheses) were 48 (0.95) in 2007, 19 (0.88) in 2008, 18 (0.92) in 2009, 4 (0.53) in 2010, and 10 (0.84) in 2011. The 2007-2011 average mortality attributed to the Northeast bottom trawl was 20 animals (0.52; Table 2).

Mid-Atlantic Bottom Trawl

During 2007-2011, 8 mortalities were observed in the mid-Atlantic bottom trawl fishery. No takes were observed in 2007 or 2008; 1 mortality was observed in 2009, 5 in 2010, and 2 in 2011. New serious injury criteria were applied to all observed interactions retroactive back to 2007. There were no observed serious injuries of bottlenose dolphins in the Mid-Atlantic region. Estimated annual fishery-related mortalities (CV in parentheses) were 11 (0.42) in 2007, 16 (0.36) in 2008, 21 (0.45) in 2009, 20 (0.34) in 2010, and 34 (0.31) in 2011. The 2007-2011 average mortality attributed to the Northeast bottom trawl was 20 animals (0.17; Table 2).

Through the Marine Mammal Authorization Program (MMAP), there were 2 self-reported incidental takes (mortalities) of bottlenose dolphins during 2011 off Rhode Island and New Jersey by fishers trawling for *Loligo* squid.

U.S. Mid-Atlantic Tuna Hook and Line Fishery

Through the MMAP, there was 1 self-reported incidental take (serious-injury) of a bottlenose dolphin during 2010 off North Carolina by a fisher using hook and line targeting tuna.

Northeast Sink Gillnet

During 2007-2011, there were no observed mortalities or serious injuries to bottlenose dolphins by this fishery. The first observed mortality of bottlenose dolphins was recorded in 2000. This was genetically identified as an offshore morphotype animal. The estimated annual fishery-related serious injury and mortality attributable to this fishery (CV in parentheses) was 0 from 1996-1999, and 132 (CV=1.16) in 2000. There was one additional observed mortality of a bottlenose dolphin presumed to be from the offshore morphotype in this fishery during 2004. ~~Total mortality estimates for 2002-2006 have not been calculated (Table 2).~~

Mid-Atlantic Gillnet

During 2007-2011, there were no observed mortalities or serious injuries to bottlenose dolphins by this fishery. Bottlenose dolphin mortalities were observed in this fishery during 1998, 2001, and 2005. In each case, the dolphin was presumed to be of the offshore morphotype based upon its location in deep water over the outer continental shelf. The only prior estimate of total mortality in the fishery was 4 (CV=0.7) for 1998. ~~Extrapolated estimates of total mortality from 2002 to2006 have not been calculated (Table 2).~~

~~Table 2. Summary of the incidental mortality of offshore morphotype bottlenose dolphins (*Tursiops truncatus*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).~~

~~Fishery~~	~~Years~~	~~Vessels~~	~~Data Type [a]~~	~~Observer Coverage [b]~~	~~Observed Mortality~~	~~Estimated Mortality~~	~~Estimated CVs~~	~~Mean Annual Mortality~~

~~Northeast Sink Gillnet~~	~~02-06~~	~~unk[e]~~	~~Obs. Data Dealer Reports, Logbooks~~	~~.02, .03, .06, .07, .04~~	~~0, 0, 1, 0, 0~~	~~0, 0, unk[d], 0, 0~~	~~0, 0, unk[d], 0, 0~~	~~unk[d]~~
~~Mid-Atlantic Gillnet~~	~~02-06~~	~~unk[e]~~	~~Obs. Data Dealer Reports~~	~~.01, .01, .02, .03, .04~~	~~0, 0, 0, 1, 0~~	~~0, 0, 0 unk[d], 0~~	~~0, 0, 0, unk[d], 0~~	~~unk[d]~~

~~a. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected by the Northeast Fisheries Observer Program. The NEFSC collects landings data (Dealer Reports), and total landings are used as a measure of total effort for the gillnet fisheries. Mandatory vessel trip reports (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery.~~
~~b. Observer coverage of the Northeast sink gillnet and mid-Atlantic coastal gillnet fisheries are ratios based on the percentage of tons of fish landed.~~
~~c. Number of vessels is not known.~~
~~d. Estimates of bycatch mortality attributed to the Northeast sink gillnet and mid-Atlantic gillnet fisheries have not been generated~~

Other Mortality

Bottlenose dolphins are among the most frequently stranded small cetaceans along the Atlantic coast. Many of the animals show signs of human interaction (*i.e.*, net marks, mutilation, etc.); however, it is unclear what proportion of these stranded animals is from the offshore morphotype.

STATUS OF STOCK

The western North Atlantic bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act, and the offshore stock is not considered strategic under the ~~U.S. MMPA~~Marine Mammal Protection Act. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching the zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. ~~The western North Atlantic offshore bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act.~~ There are insufficient data to determine the population trends for this stock~~species~~. ~~Average 2002-2006 annual U.S. fishery-related mortality and serious injury has not been estimated, and it is therefore unknown whether or not total mortality and serious injury can be considered insignificant.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic Northern Migratory Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Geographic Range and Coastal Morphotype Habitat

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula and ~~along~~ into the Gulf of Mexico~~ coast~~. Based on differences in mitochondrial DNA haplotype frequencies, ~~nearshore~~ coastal animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Rosel *et al.* 2009; Duffield and Wells 2002). On the Atlantic coast, Scott *et al.* (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-1988 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks residing in coastal waters of the western North Atlantic (Rosel *et al.* 2009; McLellan *et al.* 2003).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype ~~primarily~~ that ~~occupying~~ occupies habitats further offshore (Hoelzel *et al.* 1998; Mead and Potter 1995; Rosel *et al.* 2009). Aerial surveys conducted between 1978 and 1982 (CETAP 1982) north of Cape Hatteras, North Carolina, identified two concentrations of bottlenose dolphins, one ~~inshore~~ near the coast within ~~of~~ the 25-m isobath and the other offshore of the 50-m isobath and concentrated at the continental shelf edge. The lowest density of bottlenose dolphins was observed over the continental shelf~~, with higher densities along the coast and near the continental shelf edge~~. It was suggested, therefore, that north of Cape Hatteras, North Carolina, the coastal morphotype is restricted to waters < 25 m deep (Kenney 1990). Similar patterns were observed during summer months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al.* 2003). However, south of Cape Hatteras during both winter and summer months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al.* 2003).

To address the question of the distribution of coastal and offshore morphotypes in coastal and continental shelf waters ~~south of Cape Hatteras~~along the Atlantic coast, tissue samples were collected in coastal, shelf and slope waters from New England to Florida between 1997 and 2006~~ from large vessel surveys during the summers of 1998 and 1999, from systematic biopsy sampling efforts in nearshore waters from New Jersey to central Florida conducted in the summers of 2001 and 2002, and from winter biopsy collection effort in 2002 and 2003 in nearshore continental shelf waters of North Carolina and Georgia. Additional biopsy samples were collected in deeper continental shelf waters south of Cape Hatteras during winter 2002~~. Genetic analyses using mitochondrial DNA sequences of these biopsies identified individual animals to the coastal or offshore morphotype. Using the genetic results from all surveys combined, a logistic regression was used to model the probability that a particular bottlenose dolphin group was of the coastal morphotype as a function of environmental variables including depth, sea surface temperature, and distance from shore. These models were used to partition the bottlenose dolphin groups observed during aerial surveys between the two morphotypes (Garrison *et al.* 2003).

The genetic results and spatial patterns observed in aerial surveys indicate both regional and seasonal differences in the longitudinal distribution of the two morphotypes in coastal Atlantic waters. During summer months, all biopsy samples collected from ~~nearshore~~coastal waters north of Cape Lookout, North Carolina (< 20 m deep), were of the coastal morphotype, and all samples collected in deeper waters (> 40 m deep) were of the offshore morphotype. South of Cape Lookout, the probability of an observed bottlenose dolphin group being of the coastal morphotype declined with increasing depth. In intermediate depth waters, there was spatial overlap between the two morphotypes. Offshore morphotype bottlenose dolphins were observed at depths as shallow as 13 m, and coastal morphotype dolphins were observed at depths of 31 m and 75 km from shore (Garrison *et al*. 2003).

Winter samples were collected primarily from ~~nearshore~~coastal waters in North Carolina and Georgia~~.~~ and ~~T~~the vast majority of ~~samples collected in nearshore waters of North Carolina during winter~~them were of the coastal morphotype; however, one offshore morphotype group was sampled during November just south of Cape Lookout only 7.3 km from shore. Coastal morphotype samples were also collected farther away from shore at 33 m depth and 39 km ~~distance~~ from shore. The logistic regression model for this region indicated a decline in the probability of a

coastal morphotype group with increasing distance from shore; however, the model predictions were highly uncertain due to limited sample sizes and spatial overlap between the two morphotypes. Samples collected in Georgia waters also indicated significant overlap between the two morphotypes with a declining probability of the coastal morphotype with increasing depth. A coastal morphotype sample was collected 112 km from shore at a depth of 38 m. An offshore sample was collected in 22 m depth at 40 km from shore. As with the North Carolina model, the Georgia logistic regression predictions are uncertain due to limited sample size and high overlap between the two morphotypes (Garrison *et al.* 2003).

In summary, the primary habitat of the coastal morphotype of bottlenose dolphin extends from Florida to New Jersey during summer months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype occurs in lower densities over the continental shelf (waters between 20 m and 100 m depth) and overlaps spatially with the offshore morphotype.

Distinction Between Coastal and Estuarine Bottlenose Dolphins

In addition to inhabiting coastal nearshore waters, tThe coastal morphotype of bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Wells *et al.* 1996; Scott *et al.* 1990; Weller 1998; Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Balmer *et al.* 2008; Mazzoil *et al.* 2008). There are multiple lines of evidence supporting demographic separation between bottlenose dolphins residing within estuaries along the Atlantic coast. For example, long-term photo-identification (photo-ID) studies in waters around Charleston, South Carolina, have identified communities of resident dolphins that are seen within relatively restricted home ranges year-round (Zolman 2002; Speakman *et al.* 2006). In Biscayne Bay, Florida, there is a similar community of bottlenose dolphins with evidence of year-round residents that are genetically distinct from animals residing in a nearby estuary in Florida Bay (Litz *et al.* 2012 2007). The Indian River Lagoon system in central Florida also has a long-term photo-ID study, and this study identified year-round resident dolphins repeatedly observed across multiple years (Stolen *et al.* 2007; Mazzoil *et al.* 2008).

A few published studies demonstrate that these resident animals are genetically distinct from animals in nearby coastal waters; a study conducted near Jacksonville, Florida, demonstrated significant genetic differences between animals in nearshore coastal waters and estuarine waters (Caldwell 2001; Rosel *et al*. 2009) and animals resident in the Charleston Estuarine System show significant genetic differentiation from animals biopsied in coastal waters of southern Georgia (Rosel *et al*. 2009). In addition, stable isotope ratios of ^{18}O relative to ^{16}O (i.e., δ^{18}Oreferred to as depleted ^{18}O or depleted oxygen) in animals sampled along the Outer Banks of North Carolina between Cape Hatteras and Bogue Inlet during February and March were very low (Cortese 2000). One explanation for this depleted oxygen signature is that a resident group of dolphins in Pamlico Sound moves into nearby nearshore areas in the winter.

Despite evidence for genetic differentiation between estuarine and nearshorecoastal populations, the degree of spatial overlap between these populations remains unclear. Photo-ID studies within estuaries demonstrate seasonal immigration and emigration and the presence of transient animals (e.g., Speakman *et al.* 2006). In addition, the degree of movement of resident estuarine animals into coastal waters on seasonal or shorter time scales is poorly understood. However, for the purposes of this analysisstock definition, bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct from those inhabiting coastal habitats. Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.

Definition of the Northern Migratory Coastal Stock

Bottlenose dolphins occur along the North Carolina coast and as far north as Long Island, New York, during summer months (CETAP 1982; Kenney 1990; Garrison *et al.* 2003). During winter months, bottlenose dolphins are rarely observed in coastal waters north of the North Carolina/Virginia border, and their northern distribution appears to be limited by water temperatures < 9.5ºC (Garrison *et al.* 2003). Seasonal variation in the densities of animals observed off Virginia Beach, Virginia, also indicates the seasonal migration of dolphins northward during summer months and then south during winter (Barco and Swingle 1996).

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in of strandings during a large scale mortality event occurring during 1987-1988 (Scott *et al.* 1988). However, re-analysis of stranding data (McLellan *et al.* 2003) and extensive analysis of genetic (Rosel *et al.* 2009), photo-ID (Zolman 2002), and satellite telemetry

(~~Southeast Fisheries Science Center, unpublished~~Hohn and Hansen, NMFS unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are 5 coastal stocks of bottlenose dolphins: ~~the~~ Northern Migratory and Southern Migratory Coastal ~~s~~Stocks, a South Carolina/Georgia Coastal ~~s~~Stock, a Northern Florida Coastal ~~s~~Stock and a Central Florida Coastal ~~s~~Stock.

Among the coastal stocks, the migratory movements and spatial distribution of the Northern Migratory ~~s~~Stock are the best understood based on aerial survey data, tag-telemetry studies, photo-ID data and genetic studies. ~~Bottlenose dolphins occur along the North Carolina coast and as far north as Long Island, New York, during summer months (CETAP 1982; Kenney 1990; Garrison *et al.* 2003). During winter months, bottlenose dolphins are rarely observed north of the North Carolina/Virginia border, and their northern distribution appears to be limited by water temperatures < 9.5ºC (Garrison *et al.* 2003). Seasonal variation in the densities of animals observed off Virginia Beach, Virginia, also indicates the seasonal migration of dolphins northward during summer months and then south during winter (Barco and Swingle 1996).~~

Four dolphins tagged during 2003 and 2004 off the coast of New Jersey in late summer moved south to North Carolina and inhabited waters near and just south of Cape Hatteras during winter months. These animals then moved north to New Jersey again during the following summer (~~SEFSC, unpublished~~Hohn and Hansen, NMFS unpublished data). Similarly, a dolphin~~s~~ tagged in 1998 off Virginia Beach, Virginia, during the ~~late summer~~fall occupied the area between Cape Hatteras and Cape Lookout during winter months (NMFS 2001). There is no evidence suggesting that ~~these~~this animal~~s~~ moved farther south than Cape Lookout during winter months (NMFS 2001). In addition, there are no matches in long term photo-ID studies between sites in New Jersey and those south of Cape Hatteras (Urian *et al.* 1999; NMFS 2001).

~~In addition, there are no matches in long term photo-ID studies between sites in New Jersey and those south of Cape Hatteras (Urian *et al.* 1999; NMFS 2001).~~ Genetic analyses using mitochondrial and nuclear microsatellite data also indicated significant differentiation between bottlenose dolphins occupying coastal waters from the North Carolina/Virginia border to New Jersey during summer months and those in southern North Carolina and further south (Charleston, South Carolina, coastal Georgia and Jacksonville, Florida). One exception was the comparison using the microsatellite data of animals from Virginia and north to those in southern North Carolina (NMFS 2001; Rosel *et al.* 2009). This finding is thought to be a result of some degree of seasonal spatial overlap between the Northern Migratory Coastal Stock and other stocks occupying coastal waters of North Carolina (Rosel *et al.* 2009) because some of the samples were collected in southern North Carolina during the winter when multiple stocks are thought to be present.~~Genetic analyses also indicated significant differentiation between bottlenose dolphins occupying coastal waters from the North Carolina/Virginia border to New Jersey during summer months and those in southern North Carolina and further south (NMFS 2001; Rosel *et al.* 2009). There was a lack of differentiation in nuclear microsatellite genetic data between animals from Virginia and north and those in southern North Carolina. This is consistent with some degree of seasonal spatial overlap between the Northern Migratory ~~s~~Stock and other stocks occupying coastal waters of North Carolina (Rosel *et al.* 2009).~~

Toth *et al.* (2012) suggested the Northern Migratory Coastal Stock may be further partitioned in waters off of New Jersey. They identified two clusters of sightings that differed in presence of *Xenobalanus*, avoidance behavior and "base coloration". One cluster inhabited waters 0-1.9 km from shore while the other cluster inhabited waters 1.9-6 km from shore. Additional studies are needed to determine whether this apparent partitioning has a genetic basis.

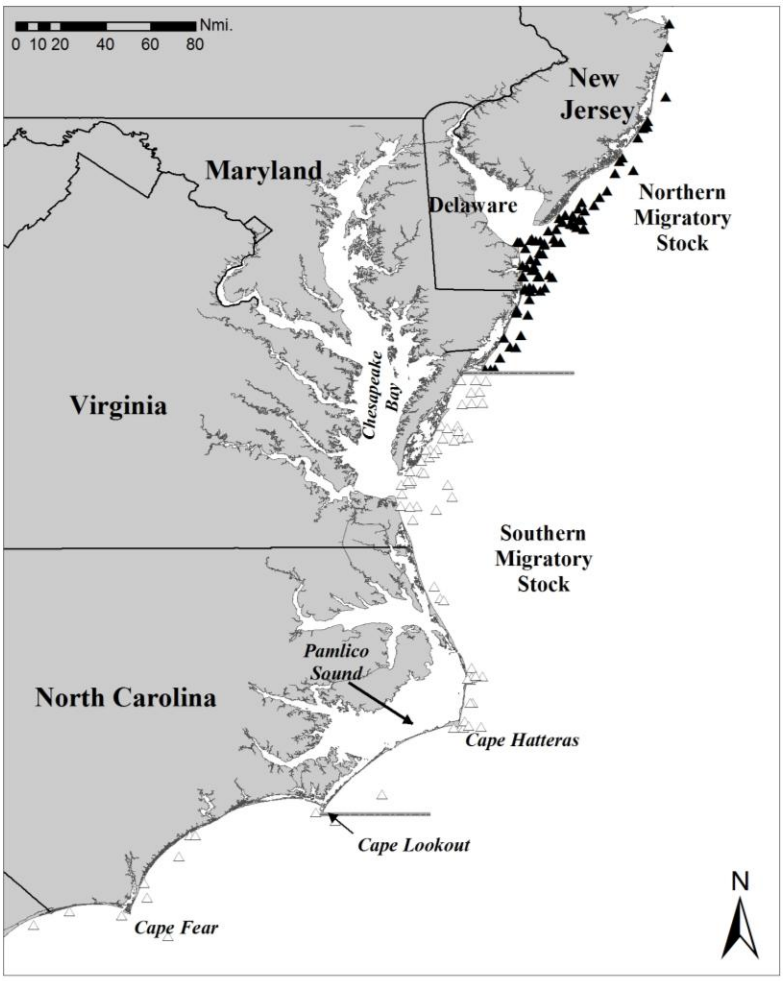

Figure 1. *The summer (July-~~September~~August) distribution of bottlenose dolphin stocks occupying coastal waters from North Carolina to New Jersey. Locations are shown from aerial surveys. Sightings assigned to the Northern Migratory stock are shown with filled symbols.*

Spatial and temporal overlap of the Northern Migratory Coastal Stock with other stocks is likely.

~~Spatial and temporal overlap of~~ ~~The available data strongly supports the presence of a distinct Northern Migratory s~~Stock~~. However, this stock does overlap spatially with other distinct groups of coastal bottlenose dolphins.~~ During summer months, ~~the degree of~~ overlap with the Southern Migratory ~~s~~Stock in coastal waters of northern North Carolina and Virginia is ~~unknown~~possible, but the degree of overlap is unknown. During winter months, the Northern Migratory Coastal ~~s~~Stock moves southward to waters from Cape Lookout, North Carolina, to north of Cape Hatteras, North Carolina, based upon tag-telemetry studies. The stock overlaps spatially with the ~~Northern North Carolina Estuarine System~~NNCES ~~s~~Stock during this period. These complex seasonal spatial movements and the overlap of coastal and estuarine stocks in the waters of North Carolina greatly limit the ability to fully assess the mortality of each of these stocks.

In summary, spatial distribution data, tag-telemetry studies, photo-ID studies and genetic studies demonstrate the existence of a distinct Northern Migratory ~~s~~Stock of coastal bottlenose dolphins. During summer months (July-~~September~~August), this stock occupies coastal waters from the shoreline to approximately the 25-m isobath between the Chesapeake Bay mouth and Long Island, New York (Figure 1). During winter months (January-March), the stock~~ moves south to waters of North Carolina and~~ occupies coastal waters from Cape Lookout, North Carolina, to the North Carolina/Virginia border.

~~Toth *et al.* (2012) suggested the Nothern Migratory Stock may be further partitioned in waters off of New Jersey. They identified two clusters of sightings that differed in presence of *Xenobalanus*, avoidance behavior and~~

~~"base coloration". One cluster inhabited waters 0-1.9 km from shore while the other cluster inhabited waters 1.9-6 km from shore. Additional studies are needed to determine whether this structure has a genetic basis.~~

POPULATION SIZE

The best available estimate for the Northern Migratory Coastal Stock of bottlenose dolphins in the western North Atlantic is 11,548 (CV=0.36; Table 1). This estimate is from aerial surveys conducted during the summers of 2010 and 2011 covering waters from Florida to New Jersey.

Earlier abundance estimates

Earlier abundance estimates for the Northern Migratory Coastal stock were derived from aerial surveys conducted during the summer of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. These surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias. In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. Observed bottlenose dolphin groups from these were partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003). For the region north of Cape Hatteras, North Carolina, there was complete separation between the coastal and offshore morphotypes, with only coastal animals occupying waters < 20 m deep. Therefore, all animals observed in the 0-20 m depth stratum during surveys of this region were assigned to the coastal morphotype (Garrison *et al.* 2003).

Summer surveys are best for estimating the abundance for both the Northern and Southern Migratory Coastal Stocks since they overlap least with other stocks during summer months. An analysis of summer survey data from 1995, 2002 and 2004 demonstrated strong inter-annual variation in the spatial distribution of presumed Southern Migratory and Northern Migratory Coastal Stock animals. Two groups of dolphins in each survey year were identified using a multivariate cluster analysis of sightings based on water temperature, depth and latitude. One group ranged from Cape Lookout, North Carolina, to just north of the Chesapeake Bay mouth, and one ranged farther north along the eastern shore of Virginia to New Jersey. The southern group (i.e., the Southern Migratory Coastal Stock) was found in water temperatures between 26.5 and 28.0°C, and the northern group (i.e., the Northern Migratory Coastal Stock) occurred in cooler waters between 24.5 and 26.0°C. The spatial distribution of these groups was strongly correlated with water temperatures and varied between years. During the summer of 2004, water temperatures were significantly cooler than those during 2002, and animals from both groups were distributed farther south and overlapped spatially. Very few bottlenose dolphins were observed in waters north of Virginia during the summer 2004 survey. Therefore, it was not possible to develop an estimate of abundance for the Northern Migratory Coastal Stock from the summer 2004 survey and so the ~~.~~

The best abundance estimate for the Northern Migratory Coastal Stock ~~was therefore~~came from the summer 2002 survey when there was little overlap and an apparent separation from the Southern Migratory Coastal Stock at approximately 37.5°N latitude. The resulting ~~best~~ abundance estimate for the Northern Migratory Coastal Stock was 9,604 (CV=0.36).

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters along the U.S. East Coast from southeastern Florida to Cape May, New Jersey, during the summers of 2010 and 2011. The surveys were conducted along tracklines oriented perpendicular to the shoreline that were latitudinally spaced 20 km apart and covered waters from the shoreline to the continental shelf break. The summer 2010 survey was conducted during 24 July–14 August 2010, and 7,944 km of on-effort tracklines completed. A total of 127 bottlenose dolphin groups were observed including 1,541 animals. During the 2011 summer survey, 8,665 km of trackline were completed between Cape May, New Jersey and Ft. Pierce, Florida. The survey was conducted during 6 July - 29 July 2011. The 2011 survey also included more closely spaced “fine-scale” tracklines in waters offshore of New Jersey and Virginia within areas being evaluated for the placement of offshore energy installations. A total of 112 bottlenose dolphin groups were sighted including 1,339 animals.

Both the summer 2010 and 2011 surveys were conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake *et al.* 2004). However, the detection functions from both surveys indicated a decreased probability of detection near the trackline, which limited the effectiveness of the method for correcting for visibility bias due to a relatively small number of sightings

made by both teams near the trackline. Abundance estimates were therefore derived by combining the sightings from both teams during a survey and "left-truncating" the data by analyzing only sightings occurring greater than 100 m from the trackline during the 2010 survey and 50 m during the 2011 survey (see Buckland *et al.* 2001 for left-truncation methodology). Detection functions were fit to these left-truncated data accounting for the effects of survey conditions (e.g., sea state, glare, water color) on the detection probabilities. A bootstrap resampling approach was used to estimate the variance of the estimates. The resulting abundance estimates assume that detection probability at the truncation distance is equal to 1. While the estimates could not be explicitly corrected for this assumption, analyses of the summer 2010 data suggest that this bias is likely small.

The abundance estimates for the Northern Migratory Coastal Stock were based upon tracklines and sightings occurring north of 37.5°N latitude and in waters from the shoreline to the 20-m isobath. Prior analyses suggested that this latitudinal boundary separates the Northern and Southern Migratory Coastal Stocks. The abundance estimate derived from the summer 2010 survey was 12,602 (CV=0.76), and the estimate from the summer 2011 survey was 11,044 (CV=0.36). The best estimate is a weighted average of these two with higher weighting given to the more precise estimate from 2011. The resulting best estimate is 11,548 (CV=0.36).

Table 1. Summary of abundance estimates for the western North Atlantic Northern Migratory Coastal Stock of bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
July-August 2002	Virginia to New Jersey	9,604	0.36
July-August 2010 and 2011	Virginia to New Jersey	11,548	0.36

~~Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. Survey effort was also stratified to optimize coverage in seasonal management units. The surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias.~~

~~The winter 2002 survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay. A total of 6,411 km of trackline was completed during the survey, and 185 bottlenose dolphin groups were sighted including 2,114 individual animals. No bottlenose dolphins were sighted north of Chesapeake Bay corresponding to water temperatures < 9.5ºC. During the summer survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia-Florida state line. A total of 185 bottlenose dolphin groups were sighted during summer including 2,544 individual animals.~~

~~In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were a total of 140 sightings of bottlenose dolphins including 3,093 individual animals. A winter survey was conducted between 30 January and 9 March 2005 covering waters from the mouth of Chesapeake Bay through central Florida. The survey covered 5,457 km of trackline and observed 135 bottlenose dolphin groups accounting for 957 individual animals.~~

~~Abundance estimates for bottlenose dolphins in the Northern Migratory s~~Stock ~~were calculated using line-transect methods and distance analysis (Buckland *et al.* 2001). The 2002 surveys included two teams of observers to derive a correction for visibility bias. The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct-duplicate estimator (Palka 1995). The resulting estimate of the probability of seeing animals on the trackline was applied to abundance estimates for the summer 2004 and winter 2005 surveys. Observed bottlenose dolphin groups were also partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003). For the region north of Cape Hatteras, North Carolina,~~

~~there was complete separation between the coastal and offshore morphotypes, with only coastal animals occupying waters < 20 m deep. Therefore, all animals observed in the 0-20 m depth stratum during surveys of this region were assigned to the coastal morphotype (Garrison *et al.* 2003).~~

~~The summer surveys are best for estimating the abundance for both the Northern and Southern Migratory Coastal sStocks since they overlap least with other stocks during summer months. An analysis of summer survey data from 1995, 2002 and 2004 demonstrated strong inter-annual variation in the spatial distribution of presumed Southern Migratory and Northern Migratory Coastal sStock animals. Two groups of dolphins in each survey year were identified using a multivariate cluster analysis of sightings based on water temperature, depth and latitude. One group ranged from Cape Lookout, North Carolina, to just north of the Chesapeake Bay mouth, and one ranged farther north along the eastern shore of Virginia to New Jersey. The southern group (i.e., the Southern Migratory Coastal sStock) was found in water temperatures between 26.5 and 28.0°C, and the northern group (i.e., the Northern Migratory Coastal sStock) occurred in cooler waters between 24.5 and 26.0°C. The spatial distribution of these groups was strongly correlated with water temperatures and varied between years. During the summer of 2004, water temperatures were significantly cooler than those during 2002, and animals from both groups were distributed farther south and overlapped spatially. Very few bottlenose dolphins were observed in waters north of Virginia during the summer 2004 survey.~~

~~The best abundance estimate for the Northern Migratory Coastal sStock is therefore from the summer 2002 survey when there was little overlap and an apparent separation from the Southern Migratory Coastal sStock at approximately 37.5°N latitude. This boundary is based upon the distribution of the two identified clusters of animals, and it likely varies between years as a function of varying water temperatures. Abundance estimates from the summer 2002 survey were derived for these stocks by post-stratifying survey effort and sightings into the identified spatial range of the two clusters of animals (Figure 1). The resulting best abundance estimate for the Northern Migratory Coastal sStock is 9,604 (CV=0.36).~~

Minimum Population Estimate

The minimum population size (Nmin) was calculated as the lower bound of the 60% confidence interval for a lognormally distributed mean (Wade and Angliss 1997). The best estimate for the Northern Migratory Coastal ~~s~~Stock of bottlenose dolphins is ~~9,604 (CV=0.36)~~ 11,548 (CV=0.36). The resulting minimum population estimate is ~~7,147~~ 8,620.

Current Population Trend

There are ~~insufficient data to determine the population trends for this stock.~~limited data available to assess population trends for this stock. The estimates from the 2002 and 2010/2011 surveys are not significantly different from each other; however, it should be noted that the relatively large CVs limit the power to detect significant differences. The statistical power to detect a trend in abundance for this species is poor due to the relatively imprecise estimates and long survey interval. For example, the power to detect a precipitous decline (i.e., 50% decrease in 15 years) in abundance with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the Northern Migratory Coastal ~~s~~Stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; (Wade and Angliss 1997). The minimum population size of the Northern Migratory Coastal ~~s~~Stock of bottlenose dolphins is ~~7,147~~ 8,620. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is depleted. PBR for this stock of bottlenose dolphins is ~~71~~ 86.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total estimated average annual fishery mortality of the Northern Migratory Coastal Stock ranges between a minimum of 3.8 and a maximum of 5.8 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

This stock has the potential to interact with the following Category I and II fisheries: (1) mid-Atlantic gillnet; (2) Virginia pound net; (3) mid-Atlantic menhaden; (4) Atlantic blue crab trap/pot, and (5) mid-Atlantic beach/haul seine. There is also the potential for this stock to interact with the Category III Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel fishery. The primary known source of fishery mortality is the mid-Atlantic coastal gillnet fishery, which has the potential to affect~~s~~ the Northern Migratory Coastal, Southern Migratory Coastal, ~~Northern North Carolina Estuarine System~~NNCES and Southern North Carolina Estuarine System (SNCES) ~~s~~Stocks of bottlenose dolphin. At certain times of year, it is not possible to definitively assign mortalities observed in that fishery to a specific stock because of the overlap amongst the 4 stocks around North Carolina. Additional fishery interactions have been reported in Virginia pound nets, beach-based gillnet gear, ~~and~~ blue crab or other pot gear, and Atlantic Ocean commercial passenger fishing vessel (hook and line) gear. However, ~~none of~~ these additional fisheries have~~s~~ limited or no systematic federal observer coverage, which prevents the estimation of total takes. Therefore, the total average annual mortality estimate is a lower bound of the actual annual human-caused mortality for each stock. Detailed fishery information is presented in Appendix III. ~~The total estimated average annual fishery mortality of the Northern Migratory Coastal stock ranges between a minimum of 5.92 and a maximum of 8.22 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.~~

Earlier Interactions

The Atlantic menhaden purse seine fishery historically reported an annual incidental take of 1 to 5 bottlenose dolphins (NMFS 1991, pp. 5-73). This information has not been updated for some time. There has been very limited observer coverage since 2008, but no takes have been observed (see Appendix III). ~~However, no observer data are available, and this information has not been updated for some time.~~

Mid-Atlantic Gillnet

This fishery has the highest documented level of mortality of coastal morphotype bottlenose dolphins, and the sink gillnet gear in North Carolina is its largest component in terms of fishing effort and observed takes. Of 12 observed mortalities between 1995 and 2000, 5 occurred in sets targeting spiny or smooth dogfish, 1 was in a set targeting "shark" species, 2 occurred in striped bass sets, 2 occurred in Spanish mackerel sets, and the remainder were in sets targeting kingfish, weakfish or finfish generically (Rossman and Palka 2001). From 2001-2008, 7 additional bottlenose dolphin mortalities were observed in the mid-Atlantic gillnet fishery in North Carolina and Virginia. ~~Three mortalities were observed in 2001 with 1 occurring off of northern North Carolina during April and 2 occurring off of Virginia during November. Four additional mortalities were observed along the North Carolina coast near Cape Hatteras: 1 in May 2003, 1 in September 2005, 1 in September 2006 and 1 in October 2006.~~ Because the Northern Migratory, Southern Migratory, ~~Northern North Carolina Estuarine System~~NNCES and ~~Southern North Carolina Estuarine System~~SNCES bottlenose dolphin stocks all occur in waters off of North Carolina, it is not possible to definitively assign all observed mortalities, or extrapolated bycatch estimates, to a specific stock. In addition, the Bottlenose Dolphin Take Reduction Plan (BDTRP) was implemented in May 2006 resulting in changes in the gear configurations and other characteristics of the fishery.

To estimate the mortality of bottlenose dolphins in the mid-Atlantic gillnet fishery, the available data were divided into the period from 2002 through April 2006 (pre-BDTRP) and from May 2006-2008 (post-BDTRP). Three alternative approaches were used to estimate bycatch rates. First, a generalized linear model (GLM) approach was

used similar to that described in Rossman and Palka (2001). This approach included all observed mortalities from 1995-2008 where the fishing gear was still in use during the period from 2002-2008. Second, a simple ratio estimator of catch per unit effort (CPUE = observed catch / observed effort) was used based directly upon the observed data. Finally, a ratio estimator pooled across years was used to estimate different CPUE values for the pre-BDTRP and post-BDTRP periods. In each case, the annual reported fishery effort (represented as reported landings) was multiplied by the estimated bycatch rate to develop annual estimates of fishery-related mortality, again similar to the approach in Rossman and Palka (2001). To account for the uncertainty in the most appropriate of these 3 alternative approaches, the average of the 3 model estimates (and the associated uncertainty) are used to estimate the mortality of bottlenose dolphins for this fishery (Table 1).

Table 1. Summary of the 2002-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus truncatus*) in the Northern Migratory Coastal ~~s~~Stock in the commercial mid-Atlantic gillnet fisheries. The estimated annual and average mortality estimates are shown for the period prior to the implementation of the Bottlenose Dolphin Take Reduction Plan (pre-BDTRP) and after the implementation of the plan (post-BDTRP). Three alternative modeling approaches were used, and the average of the 3 was used to represent mortality estimates. The minimum and maximum estimates indicate the range of uncertainty in assigning observed bycatch to stock. Observer coverage is measured as a proportion of reported landings (tons of fish landed). Data are derived from the Northeast Observer program, NER dealer data, VMRC landings and NCDMF dealer data. Values in parentheses indicated the CV of the estimate.

Period	Year	Observer Coverage[a]	Min Annual Ratio	Min Pooled Ratio	Min GLM	Max Annual Ratio	Max Pooled Ratio	Max GLM
pre-BDTRP	2002	0.01	0	0	24.75 (0.34)	0	0	27.87 (0.33)
	2003	0.01	0	0	11.77 (0.36)	0	0	19.98 (0.30)
	2004	0.02	0	0	14.57 (0.35)	0	0	21.83 (0.33)
	2005	0.03	0	0	14.67 (0.39)	0	0	19.55 (0.32)
	Jan-Apr 2006	0.03	0	0	5.92 (0.37)	0	0	6.50 (0.37)
Annual Avg. pre-BDTRP			Minimum: 4.78 (CV=0.17)			Maximum: 6.38 (CV=0.15)		
post-BDTRP	May-Dec 2006	0.03	0	0	7.99 (0.30)	0	0	9.07 (0.29)
	2007	0.03	0	0	20.66 (0.31)	0	0	24.51 (0.31)
	2008	0.01	0	0	18.75 (0.31)	0	0	20.61 (0.31)
Annual Avg. post-BDTRP			Minimum: 5.27 (CV=0.19)			Maximum: 6.02 (CV=0.19)		

[a] Observer coverage is reported on an annual basis for the entire fishery as a proportion of the reported tons of fish landed.

During 2001-2008, ~~T~~there were ~~have been~~ no observed mortalities in the mid-Atlantic gillnet fishery ~~since 2001~~

that could potentially be assigned to the Northern Migratory Coastal ~~s~~Stock. Hence, both the annual and pooled ratio estimators of bycatch rate were equal to zero in both the pre-BDTRP and post-BDTRP periods. Since the GLM approach includes information from prior to 2002, positive bycatch rates for the Northern Migratory Coastal ~~s~~Stock were estimated (Table 1). Since observed mortalities (and effort) cannot be definitively assigned to a particular stock within certain regions and times of year, the minimum and maximum possible mortality of the Northern Migratory Coastal ~~s~~Stock are presented for comparison to PBR (Table 1).

Based upon these analyses, the minimum mortality estimate for the Northern Migratory Coastal ~~s~~Stock for the pre-BDTRP period was 4.78 (CV=0.17) animals per year, and that for the post-BDTRP period was 5.27 (CV=0.19) animals per year. The maximum estimates were 6.38 (CV=0.15) for the pre-BDTRP period and 6.02 (CV=0.19) for the post-BDTRP period (Table 1).

During the last five years (2007-2011), no bottlenose dolphin takes were observed by the Northeast Fishery Observer Program (NEFOP) attributable to the mid-Atlantic gillnet fishery. NEFOP observer coverage (measured in trips) for this fishery from 2007-2011 was less than 1% in internal waters (bays, sounds, estuaries), 2.74% in state waters (0-3 miles) and 6.30% in federal waters (3-200 miles). These low levels of coverage are likely insufficient to detect bycatch of bottlenose dolphins in the mid-Atlantic commercial gillnet fishery. Due to a lack of observed takes, no new estimates of mortality in this fishery could not be generated, as indicated by the "no estimate" in Table 2 for years 2009-2011. However, serious injury and mortality from this fishery are still occurring based on other documented interactions (see Table 2). Specifically, in 2009, there was 1 observed take by the Southeast Fishery Observer Program in small-mesh gillnet gear off North Carolina targeting Spanish mackerel. This animal likely belonged to either the Northern or Southern Migratory Coastal Stock. Stranding data also documented 2 dolphin mortalities recovered with gillnet gear attached that likely belonged to the Northern Migratory Coastal Stock: (1) in 2008 in Virginia, a dead dolphin was recovered entangled in a gillnet; (2) in 2010 in Delaware, a dead dolphin was recovered with its flukes entangled in monkfish gillnet gear. These 2 mortalities were included in the stranding database and the stranding totals presented in Table 3. The documented interactions in commercial gear represent~~s~~ a minimum known count of interactions with this fishery in the last 5 years, absent sufficient observer coverage to generate mortality estimates (see Table 2).

Beach Haul Seine/Beach-based Gillnet Gear

~~Two coastal bottlenose dolphin takes were observed in beach haul seine gear: 1 in May 1998 and 1 in December 2000. These takes occurred during a striped bass fishery within the spatial and seasonal range of the Northern Migratory Coastal stock. Beach-based gillnet gear is now considered part of the Mid-Atlantic gillnet fishery described above; however, it is not included in the observer program or resulting mortality estimates.~~ Two coastal bottlenose dolphin takes were observed in beach-anchored gillnets: 1 in May 1998 and 1 in December 2000. The May 1998 take occurred while using a small mesh net targeting weakfish, and the December 2000 take occurred during a striped bass fishery. Both of these takes occurred within the spatial and seasonal range of the Northern Migratory Stock. Beach-based gillnet gear is now considered part of the mid-Atlantic gillnet fishery and has been monitored by the observer program. Data from the Southeast Region Stranding Network from 2002-2008 include ~~2~~1 confirmed report~~s~~ of a bottlenose dolphin mortality~~ies~~ in beach-based gillnet gear for striped bass during ~~winter months~~January 2008 off the coast of northern North Carolina~~: 1 in December 2002 and 1 in January 2008~~. A ~~third~~second possible mortality associated with this gear occurred during December 2002 (Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). Based upon their location and time of year, these mortalities were most likely animals from the Northern Migratory Coastal ~~s~~Stock. In 2007, one dolphin was killed in a multifilament beach seine during a state fishery research project that may belong to either the Northern Migratory or Southern Migratory Coastal Stock. Finally, in 2008, through the Marine Mammal Authorization Program, there was one self-reported bottlenose dolphin mortality in a beach seine/beach-anchored gillnet in North Carolina that likely belonged to the Northern Migratory Coastal Stock.

Crab Pots and Other Pots

During 2007-2011, there was 1 report of a bottlenose dolphin from the Northern Migratory Coastal Stock disentangled and released alive from trap/pot gear. The disentanglement and release occurred off New Jersey in 2007. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or

mortalities associated with crab pots. However, based on stranding data, it is clear that interactions with pot gear are a common occurrence and result in mortalities of coastal morphotype bottlenose dolphins in some regions (Burdett and McFee 2004). ~~Southeast Regional Marine Mammal Stranding Network data (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009) from 2004 through 2008 include 13 reports of interactions between bottlenose dolphins and confirmed blue crab pot gear with the majority of these occurring in waters from Florida to South Carolina. In addition, there were 4 interactions documented with pot gear where the fishery could not be confirmed. In these cases, the gear was confirmed to be associated with a pot or trap, but may have been from a fishery other than blue crab (e.g., whelk fisheries in Virginia). None of these confirmed mortalities could be assigned to the Northern Migratory~~ Coastal ~~stock.~~

Virginia Pound Nets

Historical and recent stranding network data report interactions between bottlenose dolphins and pound nets in Virginia. During 2007-2011, 5 bottlenose dolphin strandings, which could have belonged to the Northern Migratory Coastal Stock, were entangled in pound net gear in Virginia (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 9 November 2012). An additional 17 dolphins that could have belonged to the Northern Migratory Coastal Stock stranded with twisted twine markings indicative of interactions with pound net gear.~~Stranding data for 2004-2008 indicate 17 cases where bottlenose dolphins were removed from pound net gear, and it was determined that animals were entangled pre-mortem. In each case, the bottlenose dolphin was recovered directly from the fishing gear. Of these 17 cases, 14 were documented mortalities while 3 were released alive (S. Barco, Virginia Aquarium, unpublished data; Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009).~~ These interactions occurred primarily inside estuarine waters near the mouth of the Chesapeake Bay and in summer months.~~ Five of these mortalities occurred during May and June when they could have impacted either the Northern Migratory or Southern Migratory~~ Coastal ~~stocks.~~

Hook and Line Fisheries

During 2007-2011, 3 dolphin mortalities that could have belonged to the Northern Migratory Coastal Stock were documented as interacting with hook and/or line gear. During 2007 in New Jersey, 1 dolphin was documented with ingested hook and line gear. In 2008 in Virginia, a dolphin that could have belonged to this stock, the Southern Migratory Coastal Stock or the NNCES Stock, was documented entangled in hook and line gear. In 2009 in New Jersey, 1 dolphin was documented with ingested hook and line gear. These mortalities were included in the stranding database and are included in the stranding totals presented in Table 3.

Other Mortality

There have been occasional mortalities of bottlenose dolphins during research activities including both directed live capture studies, turtle relocation trawls, and fisheries surveys.~~There have been occasional mortalities of bottlenose dolphins during research activities including both directed live capture studies From 2002-2008, there have been 15 reported interactions during these activities resulting in 13 documented mortalities of bottlenose dolphins.~~ As mentioned above, ~~One~~1 mortality in a research beach seine was reported from June 2007 in Northern North Carolina that was consistent with the spatial range of the Northern Migratory Coastal ~~s~~Stock~~,~~ or the Southern Migratory Coastal ~~s~~Stock~~, or the Northern North Carolina Estuarine System stock~~. This animal was included in the stranding database (see Table 3). All mortalities from known sources including commercial fisheries and research related mortalities for the Northern Migratory Coastal ~~s~~Stock are summarized in Table 2.

The ~~nearshore~~coastal and estuarine habitats occupied by the coastal morphotype are adjacent to areas of high human population and some are highly industrialized. The blubber of stranded dolphins examined during the 1987-1988 mortality event contained very high concentrations of organic pollutants (Kuehl *et al.* 1991). More recent studies have examined persistent organic pollutant concentrations in bottlenose dolphin tissues from several estuaries along the Atlantic coast and have likewise found evidence of high blubber concentrations particularly in estuaries near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004), and in portions of Biscayne Bay, Florida (Litz *et al.* 2007). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Studies of contaminant concentrations relative to life history parameters showed higher

levels of mortality in first-born offspring and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on estuarine dolphins and little study of contaminant loads in migrating coastal dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

~~Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Northern Migratory Coastal stock. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. The reported mortalities in Virginia pound net, beach based gillnet and crab pot fisheries are confirmed reports and are likely an underestimate of total mortalities in these fisheries.~~

~~Year~~	~~Mid-Atlantic Gillnet~~	~~Virginia Pound Net~~	~~Beach-based Gillnet Gear~~	~~Blue Crab Pot~~	~~Other Pot~~	~~Fishery Research~~	~~Total~~
~~2004~~	~~Min = 4.9 Max = 7.3~~	~~Min = 0 Max = 3~~	~~0~~	~~0~~	~~0~~	~~0~~	~~Min = 4.9 Max = 10.3~~
~~2005~~	~~Min = 4.9 Max = 6.5~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~Min = 4.9 Max = 6.5~~
~~2006~~	~~Min = 4.6 Max = 5.2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~Min = 4.6 Max = 5.2~~
~~2007~~	~~Min = 6.9 Max = 8.2~~	~~Min = 0 Max = 2~~	~~0~~	~~0~~	~~0~~	~~Min = 0 Max = 1~~	~~Min = 6.9 Max = 11.2~~
~~2008~~	~~Min = 6.3 Max = 6.9~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~Min = 7.3 Max = 7.9~~
~~Annual Average Mortality (2004-2008)~~				~~Minimum Estimated = 5.92 Maximum Estimated = 8.22~~			

Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Northern Migratory Stock during 2007-2011 from observer and stranding data. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. This is especially the case for strandings where the maximum number reported may truly be a minimum because not all strandings are detected. They are therefore reported as the maximum greater than or equal to what was recovered.

Year	**Mid-Atlantic Gillnet**		**Virginia Pound Net (strandings and observed)**	**Beach-based Gillnet Gear (strandings)**	**Blue Crab Pot (strandings)**	**Other Pot (strandings)**	**Hook and Line (strandings)**	**Research (incidental takes)**	**Total**
	Min/Max estimate extrapolated from observer data (only through 2008)	Additional interactions known from stranding data							
2007	Min = 6.9 Max = 8.2	0	Min = 0 Max = 2	0	0	1	1	Min = 0 Max = 1	Min = 8.9 Max ≥ 13.2
2008	Min = 6.3 Max = 6.9	1	0	1	0	0	Min = 0 Max = 1	0	Min = 8.3 Max ≥ 9.9

2009	No estimate	Min = 0 Max = 1	Min = 0 Max = 2	0	0	0	1	0	Min = 1 Max ≥ 4
2010	No estimate	1	0	0	0	0	0	0	1
2011	No estimate	0	Min = 0 Max = 1	0	0	0	0	0	Min = 0 Max ≥ 1
Annual Average Mortality (2007-2011)					Minimum Estimated = 3.8 Maximum Estimated ≥ 5.8				

Strandings

Between ~~2004 and 2008~~Between 2007 and 2011, 548~~484~~ bottlenose dolphins that could be assigned to the Northern Migratory Stock stranded along the Atlantic coast between North Carolina and New York ~~that could be assigned to the Northern Migratory s~~S~~tock~~ (Table 3; Northeast Regional Marine Mammal Stranding Network; Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~21 September 2009 and 18 November 2009~~13 September 2012 (SER) and 9 November 2012 (NER)). It was not possible to determine whether ~~or not~~ there was evidence of human interaction (HI) for 348 of these strandings, and for 123 it was determined there was no evidence of HI. The remaining 77 showed evidence of HI, of which 61 (79%) were fisheries interactions (Table 3). It should be recognized that evidence of HI does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point.

The assignment of animals to a particular stock is impossible in some seasons and regions, particularly in North Carolina, Virginia and Maryland. Therefore, it is likely that the counts below include some animals from either the Southern Migratory Coastal or ~~Northern North Carolina Estuarine System~~NNCES ~~s~~Stocks. Therefore, the counts below include an unknown number of animals from the Southern Migratory Coastal and NNCES Stocks, and some of the strandings below were also included in the counts for the Southern Migratory Coastal and NNCES Stocks. In addition, stranded carcasses are not routinely identified to either the offshore or coastal morphotype of bottlenose dolphin, therefore it is possible that some of the reported strandings were of the offshore form. ~~In most cases, it was not possible to determine if a human interaction had occurred due to the decomposition state of the stranded animal. However, in cases where a determination could be made, the incidence of evidence of fisheries interactions was high, particularly in Virginia and North Carolina where the percentages of stranded animals with evidence of fisheries interaction were 57% and 45% respectively when a determination could be made. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point in the animal's life. Evidence of fishery interaction is by far the most common type of human interaction reported.~~

~~Table 3. Strandings of bottlenose dolphins from North Carolina to New York that can possibly be assigned to the Northern Migratory stock. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, in waters of North Carolina, Virginia and Maryland there is likely overlap with other stocks during particular times of year. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not.~~

~~NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009.~~

~~State~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	~~2008~~

~~Type~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~
~~North Carolina[a]~~	~~5~~	~~2~~	~~16~~	~~0~~	~~2~~	~~17~~	~~0~~	~~3~~	~~11~~	~~2~~	~~2~~	~~16~~	~~2~~	~~2~~	~~9~~
~~Virginia[b]~~	~~15~~	~~12~~	~~32~~	~~9~~	~~16~~	~~17~~	~~10~~	~~1~~	~~30~~	~~6~~	~~4~~	~~22~~	~~9~~	~~4~~	~~43~~
~~Maryland[b]~~	~~1~~	~~4~~	~~3~~	~~1~~	~~0~~	~~1~~	~~2~~	~~3~~	~~6~~	~~1~~	~~2~~	~~6~~	~~2~~	~~0~~	~~1~~
~~Delaware~~	~~1~~	~~11~~	~~4~~	~~1~~	~~1~~	~~7~~	~~2~~	~~0~~	~~8~~	~~0~~	~~0~~	~~13~~	~~0~~	~~0~~	~~3~~
~~New Jersey~~	~~2~~	~~11~~	~~2~~	~~0~~	~~7~~	~~6~~	~~3~~	~~9~~	~~3~~	~~3~~	~~5~~	~~3~~	~~0~~	~~8~~	~~3~~
~~New York~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~3~~	~~0~~	~~6~~	~~3~~	~~0~~	~~0~~	~~0~~
~~Annual Total~~	~~121~~			~~85~~			~~98~~			~~94~~			~~86~~		

~~[a] Strandings for North Carolina include data for November-April north of Cape Lookout when Northern Migratory animals may be in coastal waters. The stock identity of these strandings is highly uncertain and likely also includes animals from the Northern North Carolina Estuarine System stock.~~

~~[b] Strandings from Virginia and Maryland were assigned to stock based upon both location and time of year. Some of the strandings assigned to the Northern Migratory stock could possibly be assigned to the Southern Migratory stock or Northern North Carolina Estuarine System stock.~~

Table 3. Strandings of bottlenose dolphins from North Carolina to Maine during 2007-2011 that can possibly be assigned to the Northern Migratory Coastal Stock. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, in waters of North Carolina and Virginia there is likely overlap with other stocks during particular times of year. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 (SER) and 9 November 2012 (NER).

State	**2007**			**2008**			**2009**			**2010**			**2011**		
Type	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD
North Carolina[a]	4[b]	3	16	3[c]	2	15	1[d]	3	19	4[e]	10	14	6[f]	16	22

Virginia[g]	6[h]	4	22	9[i]	4	43	10[j]	5	51	7[k]	6	32	7[l]	3	36
Maryland	1	2	6	2[m]	0	1	0	0	1	1[n]	3	2	2[o]	1	4
Delaware	0	0	13	0	0	3	1[p]	0	10	3[q]	1	5	2[r]	2	6
New Jersey	3[s]	5	4	0	8	3	4[t]	11	2	0	10	2	1[u]	14	4
New York	0	6	3	0	2	5	0	0	2	0	1	0	0	1	2
Annual Total	98			100			120			101			129		

[a] Strandings for North Carolina include data for November-April north of Cape Lookout when Northern Migratory animals may be in coastal waters. The stock identity of these strandings is highly uncertain and likely also includes animals from the NNCES Stock.
[b] Includes 3 fisheries interactions (FI) and 1 incidental take in a research beach seine.
[c] Includes 3 FI, 1 of which was also mutilated. One FI was taken in a beach seine for striped bass.
[d] Includes 1 FI.
[e] Includes 4 FIs.
[f] Includes 5 FIs and 1 mutilation.
[g] Strandings from Virginia were assigned to stock based upon both location and time of year. Some of the strandings assigned to the Northern Migratory Stock could possibly be assigned to the Southern Migratory Coastal Stock or NNCES Stock.
[h] Includes 5 FI, 2 of which were animals (mortalities) entangled in VA pound nets.
[i] Includes 7 FI and 2 mutilations. One FI was an animal (mortality) entangled in hook and line gear, and 1 FI was an animal (mortality) entangled in gillnet gear.
[j] Includes 9 FI, 2 of which were animals (mortalities) entangled in VA pound nets.
[k] Includes 7 FIs.
[l] Includes 6 FIs, 1 of which was also a mutilation. One FI was an animal (mortality) entangled in a VA pound net.
[m] Includes 1 boat strike.
[n] Includes 1 FI.
[o] Includes 1 FI and 1 mutilation.
[p] Includes 1 boat strike.
[q] Includes 2 FIs and 1 boat strike. One of the FIs was an animal (mortality) entangled in monkfish gillnet.
[r] Includes 2 boat strikes.
[s] Includes 3 FIs, 1 of which was disentangled and released alive from trap/pot gear. One FI was an animal (mortality) that had ingested hook and line gear.
[t] Includes 3 FIs. One FI was an animal (mortality) that had ingested hook and line gear.
[u] Includes 1 FI.

STATUS OF STOCK

Bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, but the

Northern Migratory Coastal Stock –is a strategic stock due to the depleted listing under the Marine Mammal Protection ActMMPA. From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the WNA, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units and again in 2008 and 2009 to recognize resident estuarine stocks and migratory and resident coastal stocks. This stock retains the depleted designation as a result of its origins from the original western North Atlantic Coastal Stock. PBR for the Northern Migratory Stock is 86 and so the zero mortality rate goal, 10% of PBR, is 8.6. The documented annual average human-caused mortality for this stock for 2007 – 2011 ranges between a minimum of 3.8 and a maximum of 5.8. However, the total U.S. human-caused mortality and serious injury for the Northern Migratory Stock cannot be directly estimated because of the spatial overlap among the stocks of bottlenose dolphins that occupy waters of North Carolina and Virginia. In addition, there are several commercial fisheries operating within this stock's boundaries, but these have little to no observer coverage and so the documented mortalities must be considered minimum estimates of total fishery-related mortality. The total fishery-related mortality and serious injury for this stock is therefore unlikely to be less than 10% of the calculated PBR, and thus cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine population trends for this stock.The total U.S. fishery-related mortality and serious injury for the Northern Migratory stock cannot be directly estimated because of the spatial overlap among the stocks of bottlenose dolphins that occupy waters of North Carolina. In addition, several fisheries are unobserved and the reported mortalities are minimum estimates. The total mortality is therefore unlikely to be less than 10% of the calculated PBR, and thus cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This stock retains the depleted designation as a result of its origins from the coastal migratory stock. The species is not listed as threatened or endangered under the Endangered Species Act, but this is a strategic stock due to the depleted listing under the MMPA.

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic Southern Migratory Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Geographic Range and Coastal Morphotype Habitat

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula and ~~along~~into the Gulf of Mexico~~ coast~~. Based on differences in mitochondrial DNA haplotype frequencies, ~~nearshore~~coastal animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Rosel *et al.* 2009; Duffield and Wells 2002). On the Atlantic coast, Scott *et al.* (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-1988 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks residing in coastal waters of the western North Atlantic (Rosel *et al.* 2009; McLellan *et al.* 2003).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype ~~primarily occupying~~that occupies habitats further offshore (Hoelzel *et al.* 1998; Mead and Potter 1995; Rosel *et al.* 2009). Aerial surveys conducted between 1978 and 1982 (CETAP 1982) north of Cape Hatteras, North Carolina, identified two concentrations of bottlenose dolphins, one ~~inshore of~~near the coast within the 25-m isobath and the other offshore of the 50-m isobath and concentrated at the continental shelf edge. The lowest density of bottlenose dolphins was observed over the continental shelf~~, with higher densities along the coast and near the continental shelf edge~~. It was suggested, therefore, that north of Cape Hatteras, North Carolina, the coastal morphotype is restricted to waters < 25 m deep (Kenney 1990). Similar patterns were observed during summer months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al.* 2003). However, south of Cape Hatteras during both winter and summer months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al.* 2003).

To address the question of the distribution of coastal and offshore morphotypes in waters south of Cape Hatteras, tissue samples were collected in coastal, shelf and slope waters from New England to Florida between 1997 and 2006~~ from large vessel surveys during the summers of 1998 and 1999, from systematic biopsy sampling efforts in nearshore waters from New Jersey to central Florida conducted in the summers of 2001 and 2002, and from winter biopsy collection effort in 2002 and 2003 in nearshore continental shelf waters of North Carolina and Georgia. Additional biopsy samples were collected in deeper continental shelf waters south of Cape Hatteras during winter 2002~~. Genetic analyses using mitochondrial DNA sequences of these biopsies identified individual animals to the coastal or offshore morphotype. Using the genetic results from all surveys combined, a logistic regression was used to model the probability that a particular bottlenose dolphin group was of the coastal morphotype as a function of environmental variables including depth, sea surface temperature, and distance from shore. These models were used to partition the bottlenose dolphin groups observed during aerial surveys between the two morphotypes (Garrison *et al.* 2003).

The genetic results and spatial patterns observed in aerial surveys indicate both regional and seasonal differences in the longitudinal distribution of the two morphotypes in coastal Atlantic waters. During summer months, all biopsy samples collected from ~~nearshore~~coastal waters north of Cape Lookout, North Carolina (< 20 m deep), were of the coastal morphotype, and all samples collected in deeper waters (> 40 m deep) were of the offshore morphotype. South of Cape Lookout, the probability of an observed bottlenose dolphin group being of the coastal morphotype declined with increasing depth. In intermediate depth waters, there was spatial overlap between the two morphotypes. Offshore morphotype bottlenose dolphins were observed at depths as shallow as 13 m, and coastal morphotype dolphins were observed at depths of 31 m and 75 km from shore (Garrison *et al*. 2003).

Winter samples were collected primarily from ~~nearshore~~coastal waters in North Carolina and Georgia~~.~~ and ~~T~~the vast majority of ~~samples collected in nearshore waters of North Carolina during winter~~them were of the coastal morphotype; however, one offshore morphotype group was sampled during November just south of Cape Lookout only 7.3 km from shore. Coastal morphotype samples were also collected farther away from shore at 33 m depth and 39 km ~~distance~~ from shore. The logistic regression model for this region indicated a decline in the probability of a

coastal morphotype group with increasing distance from shore; however, the model predictions were highly uncertain due to limited sample sizes and spatial overlap between the two morphotypes. Samples collected in Georgia waters also indicated significant overlap between the two morphotypes with a declining probability of the coastal morphotype with increasing depth. A coastal morphotype sample was collected 112 km from shore and a depth of 38 m. An offshore sample was collected in 22 m depth at 40 km from shore. As with the North Carolina model, the Georgia logistic regression predictions are uncertain due to limited sample size and high overlap between the two morphotypes (Garrison *et al.* 2003).

In summary, the primary habitat of the coastal morphotype of bottlenose dolphin extends from Florida to New Jersey during summer months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype occurs in lower densities over the continental shelf (waters between 20 m and 100 m depth) and overlaps spatially with the offshore morphotype.

Distinction Between Coastal and Estuarine Bottlenose Dolphins

In addition to inhabiting coastal nearshore waters, t~~T~~he coastal morphotype of bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Wells *et al.* 1996; Scott *et al.* 1990; Weller 1998; Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Balmer *et al.* 2008; Mazzoil *et al.* 2008). There are multiple lines of evidence supporting demographic separation between bottlenose dolphins residing within estuaries along the Atlantic coast. For example, long-term photo-identification (photo-ID) studies in waters around Charleston, South Carolina, have identified communities of resident dolphins that are seen within relatively restricted home ranges year-round (Zolman 2002; Speakman *et al.* 2006). In Biscayne Bay, Florida, there is a similar community of bottlenose dolphins with evidence of year-round residents that are genetically distinct from animals residing in a nearby estuary in Florida Bay (Litz *et al.* 2012~~2007~~). The Indian River Lagoon system in central Florida also has a long-term photo-ID study, and this study identified year-round resident dolphins repeatedly observed across multiple years (Stolen *et al.* 2007; Mazzoil *et al.* 2008).

A few published studies demonstrate that these resident animals are genetically distinct from animals in nearby coastal waters; a study conducted near Jacksonville, Florida, demonstrated significant genetic differences between animals in ~~nearshore~~ coastal ~~waters~~ and estuarine waters (Caldwell 2001; Rosel *et al*. 2009), and animals resident in the Charleston Estuarine System show significant genetic differentiation from animals biopsied in coastal waters of southern Georgia (Rosel *et al*. 2009).

~~In addition, stable isotope ratios of ^{18}O relative to ^{16}O (referred to as depleted ^{18}O or depleted oxygen) in animals sampled along the Outer Banks of North Carolina between Cape Hatteras and Bogue Inlet during February and March were very low (Cortese 2000). One explanation for this depleted oxygen signature is that a resident group of dolphins in Pamlico Sound moves into nearby nearshore areas in the winter.~~

Despite evidence for genetic differentiation between estuarine and ~~nearshore~~coastal populations, the degree of spatial overlap between these populations remains unclear. Photo-ID studies within estuaries demonstrate seasonal immigration and emigration and the presence of transient animals (e.g., Speakman *et al.* 2006). In addition, the degree of movement of resident estuarine animals into coastal waters on seasonal or shorter time scales is poorly understood. However, for the purposes of ~~this analysis~~stock definition, bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct from those inhabiting coastal habitats. ~~Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.~~

Definition of the Southern Migratory Coastal Stock

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in strandings during a large scale mortality event occurring during 1987-1988 (Scott *et al.* 1988). However, re-analysis of stranding data (McLellan *et al.* 2003) and extensive analysis of genetic (Rosel *et al*. 2009), photo-ID (Zolman 2002), and satellite telemetry (~~Southeast Fisheries Science Center,~~Hohn and Hansen, NMFS unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are 5 coastal stocks of bottlenose dolphins: the Northern Migratory and Southern Migratory ~~s~~Stocks, a South Carolina/Georgia Coastal ~~s~~Stock, a Northern Florida Coastal ~~s~~Stock and a Central Florida Coastal ~~s~~Stock.

Among the coastal stocks, the migratory movements and spatial distribution of the Southern Migratory ~~s~~Stock are the most poorly understood. Stable isotope analysis conducted using biopsy samples from free-ranging animals

sampled in estuarine, nearshore coastal and offshore habitats suggests migratory movement of animals in coastal waters between Georgia in the winter and southern North Carolina during the summer and fall. In that study, $^{15}N\backslash^{14}N$, and $^{34}S\backslash^{32}S$ ratios of animals sampled off of Georgia during winter months were similar to those of animals sampled in waters off of southern North Carolina, near Cape Fear, during winter months (Knoff 2004). Satellite tag telemetry studies also provide evidence for a stock of dolphins migrating seasonally along the coast between North Carolina and northern Florida. Two dolphins were tagged during November 2004 just south of Cape Fear, North Carolina. One of these animals remained along the South Carolina and southern North Carolina coasts throughout the winter (January-February) while the other migrated south to Northern Florida through February. In the spring (March-June), these animals moved further north of the tagging site to Cape Hatteras, North Carolina. The tags did not last beyond June, and therefore the distribution of these animals during summer months is unknown (~~Southeast Fisheries Science Center,~~Hohn and Hansen, NMFS unpublished data).

Genetic analyses indicate significant differentiation between bottlenose dolphins occupying coastal waters from the North Carolina/Virginia border to New Jersey during summer months and those in southern North Carolina and further south (Rosel *et al.* 2009). In addition, tagging studies of animals occupying New Jersey waters during the summer indicate that animals from the Northern Migratory ~~s~~Stock do not move south of Cape Lookout, North Carolina during winter months. These data demonstrate that the Northern Migratory ~~s~~Stock is distinct from the potential Southern Migratory ~~s~~Stock. However, there is limited capability to demonstrate genetic differentiation of the Southern Migratory ~~s~~Stock from other coastal and estuarine bottlenose dolphin stocks because the Southern Migratory ~~s~~Stock overlaps spatially with at least one other stock of bottlenose dolphins throughout the year.

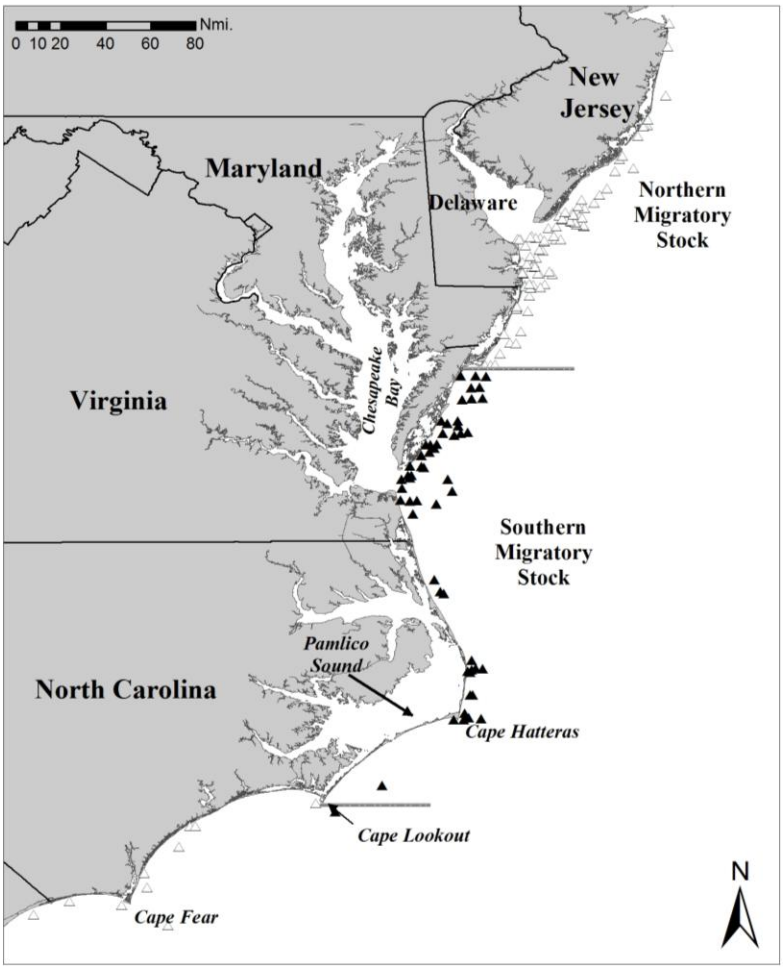

Figure 1. *The summer (July-~~September~~August) distribution of bottlenose dolphin stocks occupying coastal waters from North Carolina to New Jersey. Locations are shown from aerial surveys (triangles).~~, satellite telemetry (circles), and photo-ID studies (squares).~~ Sightings assigned to the Southern Migratory ~~s~~Stock are shown with filled symbols. ~~Photo-ID data are courtesy of Duke University and the University of North Carolina at Wilmington.~~*

In summary, the limited data available supports the definition of a Southern Migatory ~~s~~Stock of coastal morphotype bottlenose dolphins; however, there is a large amount of uncertainty in its spatial movements. The

seasonal movements are best described by tag telemetry data. During the fall (October-December), this stock occupies waters of southern North Carolina (South of Cape Lookout) where it overlaps spatially with the Southern North Carolina Estuarine System ~~s~~Stock in coastal waters. In winter months (January-March), the Southern Migratory ~~s~~Stock moves as far south as northern Florida where it overlaps spatially with the South Carolina/Georgia and Northern Florida Coastal ~~s~~Stocks. In spring (April-June), the stock moves north to waters of North Carolina where it overlaps with the Southern North Carolina Estuarine System ~~s~~Stock and the Northern North Carolina Estuarine System ~~s~~Stock. In summer months (July-August~~September~~), the stock is presumed to occupy coastal waters north of Cape Lookout, North Carolina, to the eastern shore of Virginia (Figure 1). It is possible that these animals also occur inside the Chesapeake Bay and in nearshore coastal waters where there is evidence that Northern North Carolina Estuarine System ~~s~~Stock animals also occur.

POPULATION SIZE

The best available estimate for the Southern Migratory Coastal Stock of bottlenose dolphins in the western North Atlantic is 9,173 (CV=0.46; Table 1). This estimate is from aerial surveys conducted during the summers of 2010 and 2011 covering waters from Florida to New Jersey.

Earlier abundance estimates

Earlier abundance estimates for the Southern Migratory Coastal Stock were derived from aerial surveys conducted during the summer of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. These surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias. In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. Observed bottlenose dolphin groups from these were partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003). For the region north of Cape Hatteras, North Carolina, there was complete separation between the coastal and offshore morphotypes, with only coastal animals occupying waters < 20 m deep. Therefore, all animals observed in the 0-20 m depth stratum during surveys of this region were assigned to the coastal morphotype (Garrison *et al.* 2003).

Summer surveys are best for estimating the abundance for both the Northern and Southern Migratory Coastal Stocks since they overlap least with other stocks during summer months. An analysis of summer survey data from 1995, 2002 and 2004 demonstrated strong inter-annual variation in the spatial distribution of presumed Southern Migratory and Northern Migratory Coastal Stock animals. Two groups of dolphins in each survey year were identified using a multivariate cluster analysis of sightings based on water temperature, depth and latitude. One group ranged from Cape Lookout, North Carolina, to just north of the Chesapeake Bay mouth, and one ranged farther north along the eastern shore of Virginia to New Jersey. The southern group (i.e., the Southern Migratory Coastal Stock) was found in water temperatures between 26.5 and 28.0°C, and the northern group (i.e., the Northern Migratory Coastal Stock) occurred in cooler waters between 24.5 and 26.0°C. The spatial distribution of these groups was strongly correlated with water temperatures and varied between years. During the summer of 2004, water temperatures were significantly cooler than those during 2002, and animals from both groups were distributed farther south and overlapped spatially. Very few bottlenose dolphins were observed in waters north of Virginia during the summer 2004 survey. Therefore, it was not possible to develop an estimate of abundance for the Southern Migratory Coastal Stock from the summer 2004 survey~~.~~ and so the

The best abundance estimate for the Southern Migratory Stock ~~was therefore~~came from the summer 2002 survey when there was little overlap and an apparent separation from the Northern Migratory Stock at approximately 37.5°N latitude. The resulting ~~best~~ abundance estimate for the Southern Migratory Coastal Stock was 12,482 (CV=0.32).

~~Please see Appendix IV and Table 1 for a summary of abundance estimates, including earlier estimates and survey descriptions.~~

Recent surveys and abundance estimates

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters along the U.S. East Coast from southeastern Florida to Cape May, New Jersey, during the summers of 2010 and 2011. The surveys were

conducted along tracklines oriented perpendicular to the shoreline that were latitudinally spaced 20 km apart and covered waters from the shoreline to the continental shelf break. The summer 2010 survey was conducted during 24 July–14 August 2010, and 7,944 km of on-effort tracklines completed. A total of 127 bottlenose dolphin groups were observed including 1,541 animals. During the 2011 summer survey, 8,665 km of trackline were completed between Cape May, New Jersey and Ft. Pierce, Florida. The survey was conducted during 6 July - 29 July 2011. The 2011 survey also included more closely spaced "fine-scale" tracklines in waters offshore of New Jersey and Virginia within areas being evaluated for the placement of offshore energy installations. A total of 112 bottlenose dolphin groups were sighted including 1,339 animals.

Both the summer 2010 and 2011 surveys were conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake *et al.* 2004). However, the detection functions from both surveys indicated a decreased probability of detection near the trackline, which limited the effectiveness of the method for correcting for visibility bias due to a relatively small number of sightings made by both teams near the trackline. Abundance estimates were therefore derived by combining the sightings from both teams during a survey and "left-truncating" the data by analyzing only sightings occurring greater than 100 m from the trackline during the 2010 survey and 50 m during the 2011 survey (see Buckland *et al.* 2001 for left-truncation methodology). Detection functions were fit to these left-truncated data accounting for the effects of survey conditions (e.g., sea state, glare, water color) on the detection probabilities. A bootstrap resampling approach was used to estimate the variance of the estimates. The resulting abundance estimates assume that detection probability at the truncation distance is equal to 1. While the estimates could not be explicitly corrected for this assumption, analyses of the summer 2010 data suggest that this bias is likely small.

The abundance estimates for the Southern Migratory Coastal stock ~~was~~were based upon tracklines and sightings occurring between Cape Lookout, North Carolina, and Assateague, Virginia (37.5°N latitude) and in waters from the shoreline to the 20-m isobath. Prior analyses suggested that this latitudinal boundary separates the Northern and Southern Migratory Coastal Stocks. The abundance estimate derived from the summer 2010 survey was 10,093 (CV=0.52), and the estimate from the summer 2011 survey was 7,472 (CV=0.96). The best estimate is a weighted average of these two with higher weighting given to the more precise estimate from 2010. The resulting best estimate is 9,173 (CV=0.46).

Table 1. Summary of abundance estimates for the western North Atlantic Southern Migratory Coastal Stock of bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
July-August 2002	North Carolina to Virginia	12,482	0.32
July-August 2010 and 2011	North Carolina to Virginia	9,173	0.46

~~Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January February) and summer (July August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. Survey effort was also stratified to optimize coverage in seasonal management units. The surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias.~~

~~The winter 2002 survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay. A total of 6,411 km of trackline was completed during the survey, and 185 bottlenose dolphin groups were sighted including 2,114 individual animals. No bottlenose dolphins were sighted north of Chesapeake Bay corresponding to water temperatures < 9.5ºC. During the summer survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia/Florida state line. A total of 185 bottlenose dolphin groups were sighted during summer including 2,544 individual animals.~~

~~In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with~~

~~the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were a total of 140 sightings of bottlenose dolphins including 3,093 individual animals. A winter survey was conducted between 30 January and 9 March 2005 covering waters from the mouth of Chesapeake Bay through central Florida. The survey covered 5,457 km of trackline and observed 135 bottlenose dolphin groups accounting for 957 individual animals.~~

~~Abundance estimates were calculated using line transect methods and distance analysis (Buckland *et al.* 2001). The 2002 surveys included two teams of observers to derive a correction for visibility bias. The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct duplicate estimator (Palka 1995). The resulting estimate of the probability of seeing animals on the trackline was applied to abundance estimates for the summer 2004 and winter 2005 surveys. Observed bottlenose dolphin groups were also partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003). For the region north of Cape Hatteras, North Carolina, there was complete separation between the coastal and offshore morphotypes, with only coastal animals occupying waters < 20 m deep. Therefore, all animals observed in the 0-20 m depth stratum during surveys of this region were assigned to the coastal morphotype (Garrison *et al.* 2003).~~

~~The summer surveys are best for estimating the abundance for both the Northern and Southern Migratory sStocks since they overlap least with other stocks during summer months. An analysis of summer survey data from 1995, 2002 and 2004 demonstrated strong inter-annual variation in the spatial distribution of presumed Southern Migratory and Northern Migratory sStock animals. Two groups of dolphins in each survey year were identified using a multivariate cluster analysis of sightings based on water temperature, depth and latitude. One group ranged from Cape Lookout, North Carolina, to just north of the Chesapeake Bay mouth, and one ranged farther north along the eastern shore of Virginia to New Jersey. The southern group (i.e., the Southern Migratory sStock) was found in water temperatures between 26.5 and 28.0°C, and the northern group (i.e., the Northern Migratory sStock) occurred in cooler waters between 24.5 and 26.0°C. The spatial distribution of these groups was strongly correlated with water temperatures and varied between years. During the summer of 2004, water temperatures were significantly cooler than those during 2002, and animals from both groups were distributed farther south and overlapped spatially. Very few bottlenose dolphins were observed in waters north of Virginia during the summer 2004 survey.~~

~~The best abundance estimate for the Southern Migratory sStock is therefore from the summer 2002 survey when there was little overlap and an apparent separation from the Northern Migratory sStock at approximately 37.5°N latitude. This boundary is based upon the distribution of the two identified clusters of animals, and it likely varies between years as a function of varying water temperatures. Abundance estimates from the summer 2002 survey were derived for these stocks by post-stratifying survey effort and sightings into the identified spatial range of the two clusters of animals (Figure 1). The resulting best abundance estimate for the Southern Migratory sStock is 12,482 (CV=0.32).~~

Minimum Population Estimate

The minimum population size (Nmin) was calculated as the lower bound of the 60% confidence interval for a lognormally distributed mean (Wade and Angliss 1997). The best estimate for the Southern Migratory Coastal ~~s~~Stock of bottlenose dolphins is ~~12,482~~9,173 (CV=0.46~~32~~). The resulting minimum population estimate is ~~9,591~~6,326.

Current Population Trend

There are limited data available to assess population trends for this stock. The estimates from the 2002 and 2010/2011 surveys are not significantly different from each other; however, it should be noted that the relatively large CVs limit the power to detect significant differences. The statistical power to detect a trend in abundance for this species is poor due to the relatively imprecise estimates and long survey interval. For example, the power to detect a precipitous decline (i.e., 50% decrease in 15 years) in abundance with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).

~~There are insufficient data to determine the population trends for this stock.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the Southern Migratory ~~s~~Stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean

populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; (Wade and Angliss 1997). The minimum population size of the Southern Migratory Coastal ~~s~~Stock of bottlenose dolphins is ~~9,591~~ 6,326. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is depleted. PBR for this stock of bottlenose dolphins is ~~96~~ 63.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total estimated average annual fishery mortality of the Southern Migratory Stock ranges between a minimum of 2.6 and a maximum of 16.5 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

This stock has the potential to interact with the following Category I and II fisheries: (1) mid-Atlantic gillnet; (2) Virginia pound net; (3) mid-Atlantic menhaden; (4) Atlantic blue crab trap/pot; (5) mid-Atlantic beach/haul seine; (6) Southeastern U.S. Atlantic shark gillnet; and (7) Southeast Atlantic gillnet. There is also the potential for this stock to interact with the Category III Atlantic Ocean, Gulf of Mexico, Caribbean commercial passenger fishing vessel fishery. The primary known source of fishery mortality is the mid-Atlantic gillnet fishery, which affects the Northern Migratory, Southern Migratory, Northern North Carolina Estuarine System and Southern North Carolina Estuarine System ~~s~~Stocks of bottlenose dolphins. At certain times of year, it is not possible to definitively assign mortalities observed in that fishery to a specific stock. Additional commercial fisheries that may impact the Southern Migratory ~~s~~Stock are additional ~~Virginia pound nets, blue crab or other~~ pot fisheries ~~besides blue crab, the shark gillnet~~ and the shrimp trawl fishery. With the exception of the mid-Atlantic gillnet fishery and U.S. Atlantic shark gillnet fishery, the~~se~~ above fisheries~~,~~ have limited or no~~lack~~ systematic federal observer coverage, which prevents the estimation of total takes. Therefore, the total average annual mortality estimate is a lower bound of the actual annual human-caused mortality for each stock. Detailed fishery information is presented in Appendix III. ~~The total estimated average annual fishery mortality of the Southern Migratory stock ranges between a minimum of 24.0 and a maximum of 55.0 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.~~

Earlier Interactions

The Atlantic menhaden purse seine fishery historically reported an annual incidental take of 1 to 5 bottlenose dolphins (NMFS 1991, pp. 5-73). This information has not been updated for some time. There has been very limited observer coverage since 2008, but no takes have been observed (see Appendix III).~~However, no observer data are available, and this information has not been updated for some time.~~

Mid-Atlantic Gillnet

This fishery has the highest documented level of mortality of coastal morphotype bottlenose dolphins, and ~~-~~sink gillnet gear in North Carolina is its largest component in terms of fishing effort and observed takes. Of 12 observed mortalities between 1995 and 2000, 5 occurred in sets targeting spiny or smooth dogfish, 1 was in a set targeting "shark" species, 2 occurred in striped bass sets, 2 occurred in Spanish mackerel sets, and the remainder were in sets targeting kingfish, weakfish or finfish generically (Rossman and Palka 2001). From 2001-2008, 7 additional

bottlenose dolphin mortalities were observed in the mid-Atlantic gillnet fishery in North Carolina and Virginia. ~~Three mortalities were observed in 2001 with 1 occurring off of northern North Carolina during April and 2 occurring off of Virginia during November. Four additional mortalities were observed along the North Carolina coast near Cape Hatteras: 1 in May 2003, 1 in September 2005, 1 in September 2006 and 1 in October 2006.~~ Because the Northern Migratory, Southern Migratory, Northern North Carolina Estuarine System and Southern North Carolina Estuarine System bottlenose dolphin stocks all occur in waters off of North Carolina, it is not possible to definitively assign all observed mortalities, or extrapolated bycatch estimates, to a specific stock. In addition, the Bottlenose Dolphin Take Reduction Plan (BDTRP) was implemented in May 2006 resulting in changes in the gear configurations and other characteristics of the fishery.

To estimate the mortality of bottlenose dolphins in the mid-Atlantic gillnet fishery, the available data were divided into the period from 2002 through April 2006 (pre-BDTRP) and from May 2006 through 2008 (post-BDTRP). Three alternative approaches were used to estimate bycatch rates. First, a generalized linear model (GLM) approach was used similar to that described in Rossman and Palka (2001). This approach included all observed mortalities from 1995-2008 where the fishing gear was still in use during the period from 2002-2008. Second, a simple ratio estimator of catch per unit effort (CPUE = observed catch / observed effort) was used based directly upon the observed data. Finally, a ratio estimator pooled across years was used to estimate different CPUE values for the pre-BDTRP and post-BDTRP periods. In each case, the annual reported fishery effort (represented as reported landings) was multiplied by the estimated bycatch rate to develop annual estimates of fishery-related mortality similar to the approach in Rossman and Palka (2001). To account for the uncertainty in the most appropriate of these 3 alternative approaches, the average of the 3 model estimates (and the associated uncertainty) are used to estimate the mortality of bottlenose dolphins for this fishery (Table 1).

Table 1. Summary of the 2002-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus truncatus*) in the Southern Migratory ~~s~~Stock in commercial mid-Atlantic gillnet fisheries. The estimated annual and average mortality estimates are shown for the period prior to the implementation of the Bottlenose Dolphin Take Reduction Plan (pre-BDTRP) and after the implementation of the plan (post-BDTRP). Three alternative modeling approaches were used, and the average of the 3 was used to represent mortality estimates. The minimum and maximum estimates indicate the range of uncertainty in assigning observed bycatch to stock. Observer coverage is measured as a proportion of reported landings (tons of fish landed). Data are derived from the Northeast Observer program, NER dealer data, VMRC landings and NCDMF dealer data. Values in parentheses indicated the CV of the estimate.

Period	Year	Observer Coverage[a]	Min Annual Ratio	Min Pooled Ratio	Min GLM	Max Annual Ratio	Max Pooled Ratio	Max GLM
pre-BDTRP	2002	0.01	0	29.17 (0.97)	6.71 (0.40)	0	67.83 (0.68)	24.22 (0.45)
	2003	0.01	0	34.77 (0.68)	12.35 (0.36)	63.56 (0.99)	47.08 (0.97)	14.00 (0.40)
	2004	0.02	0	81.52 (0.97)	18.93 (0.39)	0	88.56 (0.68)	31.71 (0.45)
	2005	0.03	114.84 (1)	74.05 (0.68)	19.41 (0.42)	123.18 (1.02)	91.01 (0.97)	26.61 (0.45)
	Jan-Apr 2006	0.03	0	0	0.00	0	0	0.32 (0.42)
Annual Avg. pre-BDTRP			Minimum: 21.81 (CV=0.13)			Maximum: 34.03 (CV=0.12)		
post-BDTRP	May-Dec 2006	0.03	0	0	12.10 (0.48)	174.98 (0.70)	44.29 (0.69)	18.99 (0.51)

2007	0.03	0	0	10.75 (0.35)	0	36.62 (0.69)	18.33 (0.44)
2008	0.01	0	0	28.54 (0.51)	0	86.60 (0.69)	36.45 (0.52)
Annual Avg. post-BDTRP		Minimum: 5.71 (CV=0.31)			Maximum: 41.91 (CV=0.14)		

[a] Observer coverage is reported on an annual basis for the entire fishery as a proportion of the reported tons of fish landed.

During 2001-2008, ~~T~~there were~~have been~~ 4 observed takes in the mid-Atlantic gillnet fishery~~ since 2001~~ that could potentially be assigned to the Southern Migratory ~~s~~Stock. Three of these occurred relatively close to shore and in areas with potential overlap with the Northern North Carolina Estuarine System ~~s~~Stock. A fourth occurred several kilometers from shore in northern North Carolina during summer months, and therefore is most likely to be from the Southern Migratory ~~s~~Stock. These interactions are reflected in positive values for both the pooled and annual ratio estimators (Table 1). Since observed mortalities (and effort) cannot be definitively assigned to a particular stock within certain regions and times of year, the minimum and maximum possible mortality of the Southern Migratory ~~s~~Stock are presented for comparison to PBR (Table 1).

Based upon these analyses, the minimum mortality estimate for the Southern Migratory ~~s~~Stock for the pre-BDTRP period was 21.81 (CV=0.13) animals per year, and that for the post-BDTRP period was 5.71 (CV=0.31) animals per year. The maximum estimates were 34.03 (CV=0.12) for the pre-BDTRP period and 41.91 (CV=0.14) for the post-BDTRP period (Table 1).

During the last five years (2007-2011), there were no observed takes by the Northeast Fishery Observer Program (NEFOP) attributed to the mid-Atlantic gillnet fishery, but serious injury and mortality are documented by other sources. The average percent federal observer coverage (measured in trips) for this fishery by the NEFOP from 2007-2011 was less than 1% in internal waters (bays, sounds, estuaries), 2.74% in state waters (0-3 miles) and 6.30% in federal waters (3-200 miles). These low levels of coverage are likely insufficient to detect bycatch of coastal bottlenose dolphins in the mid-Atlantic commercial gillnet fishery. Due to a lack of observed takes, no new estimates of mortality in this fishery could be generated, as indicated by the "no estimate" in Table 2 for years 2009-2011. However, serious injury and mortality from this fishery are still occurring based on other documented interactions (see Table 2). Specifically, in 2009, there was 1 observed take by the Southeast Fishery Observer Program in small mesh gillnet gear off North Carolina targeting Spanish mackerel. This likely belonged to either the Northern or Southern Migratory Coastal Stock. In 2011 the stranding network recovered a dead dolphin from a fisherman who had incidentally caught it in a small-mesh gillnet targeting spot in North Carolina. This animal could have belonged to the Southern Migratory Coastal or ~~NNCES~~Southern North Carolina Estuar~~y~~ine System Stock. The documented interactions in commercial gear represent minimum known counts of interactions with this fishery in the last 5 years, absent sufficient observer coverage to generate mortality estimates (see Table 2). In addition, 2 incidental takes (mortalities) in research gillnet gear are documented that could have belonged to the Southern Migratory Coastal or NNCES Stocks: (1) in 2009 during a small mesh gillnet research project targeting Spanish mackerel in North Carolina; and (2) in 2010 during a small mesh gillnet research project targeting sharks in North Carolina. All of these are included in the stranding database and the stranding totals in Table 3.

Crab Pots and Other Pots

During 2007-2011, there were 2 reported mortalities of bottlenose dolphins in trap/pot gear that could be assigned to either the Southern Migratory Coastal or NNCES Stocks. In 2007, 1 dolphin was reported entangled in trap/pot gear for which the fishery type could not be confirmed. In 2009, 1 dolphin was reported entangled in blue crab pot gear. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, based on stranding data, it is clear that interactions with pot gear are a common occurrence and result in mortalities of coastal morphotype bottlenose dolphins in some regions (Burdett and McFee 2004). ~~Southeast Regional Marine Mammal Stranding Network data (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18~~

~~November 2009) from 2004 through 2008 include 13 reports of interactions between bottlenose dolphins and confirmed blue crab pot gear with the majority of these occurring in waters from Florida to South Carolina. In addition, there were 4 interactions documented with pot gear where the fishery could not be confirmed. In these cases, the gear was confirmed to be associated with a pot or trap, but may have been from a fishery other than blue crab (e.g., whelk fisheries in Virginia). There was one mortality in pot gear where the fishery type could not be confirmed in Virginia. This mortality was reported in August 2007 and could be assigned to either the Southern Migratory or the NNCES stock.~~

Virginia Pound Nets

Historical and recent stranding network data report interactions between bottlenose dolphins and pound nets in Virginia. During 2007-2011, 11 bottlenose dolphin strandings which could have belonged to the Southern Migratory Coastal Stock were entangled in pound net gear in Virginia (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 9 November 2012).~~Stranding data for 2004-2008 indicate 17 cases where bottlenose dolphins were removed from pound net gear, and it was determined that animals were entangled pre-mortem. In each case, the bottlenose dolphin was recovered directly from the fishing gear. Of these 17 cases, 14 were documented mortalities while 3 were released alive (S. Barco, Virginia Aquarium, unpublished data; Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009).~~ An additional 26 dolphins that could have belonged to the Southern Migratory Coastal Stock stranded with twisted twine markings indicative of interactions with pound net gear. These interactions occurred primarily inside estuarine waters near the mouth of the Chesapeake Bay and in summer months. ~~Five of these mortalities occurred during May and June when they could have impacted either the Northern Migratory or Southern Migratory stocks. The other 9 mortalities occurred during the summer (July-September) when they could have impacted either the Southern Migratory or the Northern North Carolina Estuarine System stocks.~~ The overall impact of the Virginia Pound Net fishery on the Southern Migratory ~~s~~Stock is unknown due to the limited information on the stock's movements, particularly whether or not it occurs within waters inside the mouth of the Chesapeake Bay.

Southeastern U.S. Atlantic Shark Gillnet Fishery and Southeast Atlantic Gillnet Fishery

Gillnet fisheries targeting finfish and sharks operate in southeast waters between North Carolina and southern Florida. Historically, a drift net fishery targeting coastal sharks operated in waters in northern Florida during winter months that could have interacted with the Southern Migratory ~~s~~Stock. Bottlenose dolphin takes (n=2) in the drift net fisheries in this area were documented in 2002 and 2003 (Garrison 2007). Currently, gillnet fisheries include a number of different fishing methods and gear types including drift nets, "strike" fishing and anchored ("sink") gillnets. The majority of this fishing is reported from waters of North Carolina and central Florida, and very little effort is reported during winter months (January-March) within the range of the Southern Migratory ~~s~~Stock. There have been no observed recent bottlenose dolphin takes within the stock boundaries.

Southeastern U.S. Shrimp Trawl Fishery

In August 2002 in Beaufort County, South Carolina, a fisherman self-reported a dolphin entanglement in a commercial shrimp trawl. However, this is outside of the seasonal range of the Southern Migratory ~~s~~Stock in these waters, and there is relatively little effort during winter months when the fishery could possibly interact with this stock. No other bottlenose dolphin mortality or serious injury has been reported to NMFS. There has been very little systematic observer coverage of this fishery during the last decade.

Hook and Line Fisheries

During 2007-2011, 4 dolphins in the stranding database that could have belonged to the Southern Migratory Coastal Stock were documented as interacting with hook and/or line gear. In 2008 in Virginia, a dolphin (mortality) that could have belonged to this stock, the Northern Migratory Coastal Stock or the NNCES Stock, was documented entangled in hook and line gear. During 2010 in South Carolina an animal that may have belonged to this stock or to the South Carolina/Georgia Coastal Stock was documented with ingested recreational hook and line gear (wrapped around its goosebeak). In 2011 an additional animal stranded in South Carolina that may have belonged to this stock or to the South Carolina/Georgia Coastal Stock, and it had also ingested hook and line gear. In 2011 in Virginia, a

dolphin that could have belonged to this stock or the NNCES Stock was documented entangled in hook and line gear. These mortalities were included in the stranding database and are included in the stranding totals presented in Table 3.

Beach Haul Seine/Beach-based Gillnet Gear

Beach-based gillnet gear is now considered part of the mid-Atlantic gillnet fishery and has been monitored by the observer program. In 2007, one dolphin was killed in a multifilament beach seine during a state fishery research project that may belong to either the Northern Migratory or Southern Migratory Coastal Stock.

Other Mortality

~~There have been occasional mortalities of bottlenose dolphins during research activities including directed live capture studies, turtle relocation trawls and fisheries surveys. From 2002-2008, there have been 15 reported interactions during research activities resulting in 13 documented mortalities of bottlenose dolphins.~~ A mortality occurred~~ing~~ in a turtle relocation trawl off of North Carolina during March of 2002 ~~could have been~~ attributable~~ed~~ to either the Southern Migratory Coastal ~~stock~~ or ~~the~~ NNCES~~Northern North Carolina Estuarine System~~ ~~s~~Stock. One mortality in a research beach seine was reported from June 2007 in northern North Carolina that was consistent with the spatial range of the Northern Migratory ~~s~~Stock~~,~~ or the Southern Migratory ~~s~~Stock ~~or the Northern North Carolina Estuarine System stock~~. A second mortality was observed in research gear during 2009 in a Spanish mackerel gillnet, and a third mortality was observed in research gear during 2010 in a small mesh gillnet targeting shark. The second and third mortalities could have belonged to the NNCES or Southern Migratory Stocks. All 3 mortalities resulting from research gillnet gear were included in the stranding database and are included in Table 3. All mortalities from known sources including commercial fisheries and research related mortalities for the Southern Migratory Coastal ~~each provisional~~ ~~s~~Stock are summarized in Table 2.

The nearshore and estuarine habitats occupied by the coastal morphotype are adjacent to areas of high human population and some are highly industrialized. The blubber of stranded dolphins examined during the 1987-1988 mortality event contained very high concentrations of organic pollutants (Kuehl *et al.* 1991). More recent studies have examined persistent organic pollutant concentrations in bottlenose dolphin tissues from several estuaries along the Atlantic coast and have likewise found evidence of high blubber concentrations particularly in estuaries near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004), and in portions of Biscayne Bay, Florida (Litz *et al.* 2007). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on estuarine dolphins and little study of contaminant loads in migrating coastal dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

~~Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Southern Migratory stock. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. The reported mortalities in Virginia pound net and pot fisheries are confirmed reports and are likely an underestimate of total mortalities in these fisheries.~~

~~Year~~	~~Mid-Atlantic Gillnet~~	~~Virginia Pound Net~~	~~Blue Crab Pot~~	~~Other Pot~~	~~Research~~	~~Total~~
~~2004~~	~~Min = 33.5~~ ~~Max = 40.1~~	~~Min = 0~~ ~~Max = 6~~	~~0~~	~~0~~	~~0~~	~~Min = 33.5~~ ~~Max = 46.1~~
~~2005~~	~~Min = 69.4~~ ~~Max = 80.3~~	~~Min = 0~~ ~~Max = 1~~	~~0~~	~~0~~	~~0~~	~~Min = 69.4~~ ~~Max = 81.3~~

~~2006~~	~~Min = 4.0~~ ~~Max = 79.5~~	~~Min = 0~~ ~~Max = 2~~	~~0~~	~~0~~	~~0~~	~~Min = 4.0~~ ~~Max = 81.5~~
~~2007~~	~~Min = 3.6~~ ~~Max = 18.3~~	~~Min = 0~~ ~~Max = 3~~	~~0~~	~~Min = 0~~ ~~Max = 1~~	~~Min = 0~~ ~~Max = 1~~	~~Min = 3.6~~ ~~Max = 23.3~~
~~2008~~	~~Min = 9.5~~ ~~Max = 41.0~~	~~Min = 0~~ ~~Max = 2~~	~~0~~	~~0~~	~~0~~	~~Min = 9.5~~ ~~Max = 43.0~~
~~Annual Average Mortality (2004-2008)~~			~~Minimum Estimated = 24.00~~ ~~Maximum Estimated = 55.04~~			

Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Southern Migratory Stock during 2007-2011 from observer and stranding data. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. This is especially the case for strandings where the maximum number reported may truly be a minimum because not all strandings are detected. They are therefore reported as the maximum greater than or equal to what was recovered.

Year	**Mid-Atlantic Gillnet**		**SE Gillnet (incidental takes)**	**Beach-based Gillnet Gear (strandings)**	**Virginia Pound Net (strandings and observed)**	**Blue Crab Pot (strandings)**	**Other Pot (strandings)**	**Hook and Line (strandings)**	**Research (incidental takes)**	**Total**
	Min/Max estimate extrapolated from observer data (only through 2008)	Additional interactions known from stranding data or observer data								
2007	Min = 3.6 Max = 18.3	0	0	Min = 0 Max = 1	Min = 0 Max = 4	0	Min = 0 Max = 1	0	Min = 0 Max = 1	Min = 3.6 Max ≥ 25.3
2008	Min = 9.5 Max = 41.0	0	0	0	Min = 0 Max = 2	0	0	Min = 0 Max = 1	Min = 0 Max = 0	Min = 9.5 Max ≥ 44.0
2009	No estimate	Min = 0 Max = 1	0	0	Min = 0 Max = 4	Min = 0 Max = 1	0	0	Min = 0 Max = 1	Min = 0 Max ≥ 7
2010	No estimate	0	0	0	0	0	0	Min = 0 Max = 1	Min = 0 Max = 1	Min = 0 Max ≥ 2
2011	No estimate	Min = 0 Max = 1	0	0	Min = 0 Max = 1	0	0	Min = 0 Max = 2	0	Min = 0 Max ≥ 4
Annual Average Mortality (2007-2011)					Minimum Estimated = 2.6 Maximum Estimated ≥ 16.5					

Strandings

~~Between 2004 and 2008, 588~~During 2007-2011, 533 bottlenose dolphins stranded along the Atlantic coast

between Florida and ~~Maryland~~Virginia that could potentially be assigned to the Southern Migratory ~~s~~Stock (Table 3; Northeast Regional Marine Mammal Stranding Network; Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~21 September 2009 and 18 November 2009~~13 September 2012 (SER) and 9 November 2012 (NER)). It was not possible to determine whether or not there was evidence of human interaction (HI) for 348 of these strandings, and for 89 it was determined there was no evidence of HI. The remaining 96 showed evidence of HI, of which 79 (82%) were fisheries interactions (Table 3). It should be recognized that evidence of HI does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point.

The assignment of animals to a particular stock is impossible in some seasons and regions. During spring and summer months in North Carolina, Virginia and Maryland, the stock overlaps with the Northern Migratory Coastal, Northern North Carolina Estuarine System and the Southern North Carolina Estuarine System ~~s~~Stocks. During fall and winter months, the stock overlaps with the Southern North Carolina Estuarine System ~~s~~Stock, the South Carolina/Georgia Coastal ~~s~~Stock, and the Northern Florida Coastal ~~s~~Stock. Therefore, the counts below include an unknown number of animals from these other stocks, and some of the strandings below were also included in the counts for these other stocks. In addition, stranded carcasses are not routinely identified to either the offshore or coastal morphotype of bottlenose dolphin, therefore it is possible that some of the reported strandings were of the offshore form. ~~In most cases, it was not possible to determine if a human interaction had occurred due to the decomposition state of the stranded animal. However, in cases where a determination could be made, the incidence of evidence of fisheries interactions was high, particularly in Virginia and North Carolina where the percentages of stranded animals with evidence of fisheries interaction were 61% and 44% respectively when a determination could be made. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point in the animal's life. Evidence of fishery interaction is by far the most common type of human interaction reported.~~

~~Table 3. Strandings of bottlenose dolphins from North Carolina to New York that can possibly be assigned to the Southern Migratory stock. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, in waters of North Carolina, Virginia and Maryland there is likely overlap with other stocks during particular times of year. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009.~~

~~State~~	~~2004~~			~~2005~~			~~2006~~			~~2007~~			~~2008~~		
~~Type~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~
~~Maryland[a]~~	~~1~~	~~3~~	~~1~~	~~1~~	~~0~~	~~3~~	~~1~~	~~2~~	~~4~~	~~1~~	~~0~~	~~3~~	~~1~~	~~0~~	~~0~~
~~Virginia[a]~~	~~20~~	~~12~~	~~36~~	~~12~~	~~18~~	~~25~~	~~13~~	~~4~~	~~36~~	~~11~~	~~5~~	~~30~~	~~13~~	~~4~~	~~44~~
~~North Carolina[b]~~	~~9~~	~~10~~	~~28~~	~~6~~	~~7~~	~~35~~	~~1~~	~~4~~	~~22~~	~~6~~	~~8~~	~~25~~	~~5~~	~~5~~	~~25~~
~~South Carolina[c] (Dec-Mar)~~	~~1~~	~~3~~	~~5~~	~~2~~	~~6~~	~~4~~	~~1~~	~~2~~	~~8~~	~~0~~	~~8~~	~~10~~	~~1~~	~~1~~	~~5~~

~~Georgia[d] (Jan-Feb)~~	~~0~~	~~0~~	~~2~~	~~0~~	~~1~~	~~1~~	~~0~~	~~0~~	~~2~~	~~1~~	~~1~~	~~1~~	~~0~~	~~0~~	~~3~~
~~Florida[d] (Jan-Feb)~~	~~0~~	~~2~~	~~1~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~4~~	~~0~~	~~0~~	~~8~~	~~0~~	~~0~~	~~1~~
~~Annual Total~~	~~134~~			~~124~~			~~104~~			~~118~~			~~108~~		

~~[a] Strandings from Virginia and Maryland were assigned to stock based upon location and time of year with most occurring between May and September that could be assigned to the Southern Migratory stock. Some of these strandings could also be assigned to the Northern Migratory stock or Northern North Carolina Estuarine System stock.~~

~~[b] Strandings from North Carolina were assigned based on location and time of year. During summer and fall, some of these strandings could also be assigned to the Northern North Carolina Estuarine System or Southern North Carolina Estuarine System stocks.~~

~~[c] Strandings in coastal waters from South Carolina during December March are potentially from the Southern Migratory stock or the South Carolina/Georgia Coastal resident stock.~~

~~[d] Strandings in Georgia and northern Florida during January and February could also be assigned to the South Carolina/Georgia or the Northern Florida Coastal resident stocks, respectively.~~

Table 3. Strandings of bottlenose dolphins from Virginia to Florida that can possibly be assigned to the Southern Migratory Stock. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, in waters of North Carolina and Virginia there is likely overlap with other stocks during particular times of year. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 (SER) and 9 November 2012 (NER).

State	**2007**			**2008**			**2009**			**2010**			**2011**		
Type	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD
Maryland[a]	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
Virginia[a]	11[e]	5	28	13[f]	2	41	14[g]	6	54	7[h]	6	37	7[i]	5	31
North Carolina[b]	6[j]	8	30	8[k]	5[l]	29[m]	9[n]	5	19	6[o]	18	18	10[p]	13	20
South Carolina[c] (Dec-Mar)	0	4	5	0	0	4	0	4	2	1[q]	3	1	1[r]	2	5

Georgia[d] (Jan-Feb)	1	1	0	0	0	1	0	0	0	0	0	2	2	0	2
Florida[d] (Jan-Feb)	0	0	8	0	0	1	0	1	1	0	0	3	0	1	4
Annual Total	108			104			115			102			104		

[a] Strandings from Virginia and Maryland were assigned to stock based upon location and time of year with most occurring between May and September that could be assigned to the Southern Migratory Stock. Some of these strandings could also be assigned to the Northern Migratory Stock or Northern North Carolina Estuarine System Stock.
[b] Strandings from North Carolina were assigned based on location and time of year. During summer and fall, some of these strandings could also be assigned to the Northern North Carolina Estuarine System or Southern North Carolina Estuarine System Stocks.
[c] Strandings in coastal waters from South Carolina during December-March are potentially from the Southern Migratory Stock or the South Carolina/Georgia Coastal Stock.
[d] Strandings in Georgia and northern Florida during January and February could also be assigned to the South Carolina/Georgia or the Northern Florida Coastal Stocks, respectively.
[e] Includes 10 fisheries interactions (FI), 4 of which were animals (mortalities) entangled in VA pound nets.
[f] Includes 12 FIs, 2 of which were animals (mortalities) entangled in VA pound nets, and another of which was an animal (mortality) entangled in hook and line gear. Also includes 1 mutilation.
[g] Includes 14 FIs, 4 of which were animals (mortalities) entangled in VA pound nets.
[h] Includes 5 FIs and 1 boat strike.
[i] Includes 6 FIs, 1 of which was also mutilated. One FI was an animal (mortality) entangled in a VA pound net.
[j] Includes 3 FIs and 1 incidental take in a research beach seine.
[k] Includes 8 FIs. One animal had also been mutilated and another had also been boat struck.
[l] Includes a mass stranding of 2 animals.
[m] Includes a mass stranding of 2 animals.
[n] Includes 8 FIs. One FI was an entanglement interaction (mortality) with blue crab pot gear. Also includes 1 incidental take in gillnet research gear. The research gear was a Spanish mackerel commercial fishing gillnet.
[o] Includes 4 FIs and 1 mutilation. One FI was an incidental take in research experimental gillnet gear targeting shark.
[p] Includes 7 FIs, 1 of which was a gillnet entanglement mortality from the mid-Atlantic gillnet fishery.
[q] Includes 1 FI (mortality) in which an animal ingested recreational hook and line gear.
[r] Includes 1 FI (mortality) in which an animal ingested hook and line gear.

STATUS OF STOCK

Bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, but the Southern Migratory Coastal Stock –is a strategic stock due to the depleted listing under the Marine Mammal Protection Act~~MMPA~~. From 1995 to 2001, NMFS recognized only a single migratory stock of coastal morphotype bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units and again in 2008 and 2009 to recognize resident estuarine stocks and migratory and resident coastal stocks. This stock retains the depleted designation as a result of its origins from the original western North Atlantic Coastal Stock. PBR for the Southern Migratory Stock is 63 and so the zero mortality rate goal, 10% of PBR, is 6.3. The documented annual average human-caused mortality for this stock for 2007 – 2011 ranges between a minimum of 2.6 and a maximum of 16.5. However, the total U.S. human-caused mortality and serious injury for the Southern Migratory Stock cannot be directly estimated because of the spatial overlap among the stocks of bottlenose dolphins that occupy waters of North Carolina. In addition, there are several commercial fisheries operating within this stock's boundaries, but

these have little to no observer coverage and so the documented mortalities must be considered minimum estimates of total fishery-related mortality. The total fishery-related mortality and serious injury for this stock is therefore unlikely to be less than 10% of the calculated PBR, and thus cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine population trends for this stock.

~~The total U.S. fishery-related mortality and serious injury for the Southern Migratory stock cannot be directly estimated because of the spatial overlap among the stocks of bottlenose dolphins that occupy waters of North Carolina. In addition, several fisheries are unobserved and the reported mortalities are minimum estimates. The total mortality is therefore unlikely to be less than 10% of the calculated PBR, and thus cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This stock retains the depleted designation as a result of its origins from the coastal migratory stock. The species is not listed as threatened or endangered under the Endangered Species Act, but this is a strategic stock due to the depleted listing under the MMPA.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic South Carolina/Georgia Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Geographic Range and Coastal Morphotype Habitat

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula and ~~along~~into the Gulf of Mexico~~ coast~~. Based on differences in mitochondrial DNA haplotype frequencies, ~~nearshore~~coastal animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Duffield and Wells 2002; Rosel *et al.* 2009). On the Atlantic coast, Scott *et al.* (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-1988 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks residing in coastal waters of the western North Atlantic (McLellan *et al.* 2003; Rosel *et al.* 2009).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype ~~primarily occupying~~that occupies habitats further offshore (Mead and Potter 1995; Hoelzel *et al.* 1998; Rosel *et al.* 2009). Aerial surveys conducted between 1978 and 1982 (CETAP 1982) north of Cape Hatteras, North Carolina, identified two concentrations of bottlenose dolphins, one ~~inshore of~~near the coast within the 25-m isobath and the other offshore of the 50-m isobath and concentrated at the continental shelf edge. The lowest density of bottlenose dolphins was observed over the continental shelf~~, with higher densities along the coast and near the continental shelf edge~~. It was suggested, therefore, that north of Cape Hatteras, North Carolina, the coastal morphotype is restricted to waters <25 m deep (Kenney 1990). Similar patterns were observed during summer months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al.* 2003). However, south of Cape Hatteras during both winter and summer months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al.* 2003).

~~To address the question of~~ the distribution of coastal and offshore morphotypes in waters south of Cape Hatteras, tissue samples were collected in coastal, shelf and slope waters from New England to Florida between 1997 and 2006~~during large vessel surveys during the summers of 1998 and 1999, during systematic biopsy sampling efforts in nearshore waters from New Jersey to central Florida conducted in the summers of 2001 and 2002, and during winter biopsy collection efforts in 2002 and 2003, in nearshore continental shelf waters of North Carolina and Georgia. Additional biopsy samples were collected in deeper continental shelf waters south of Cape Hatteras during winter 2002~~. Genetic analyses using mitochondrial DNA sequences of these biopsies identified individual animals to the coastal or offshore morphotype. Using the genetic results from all surveys combined, a logistic regression was used to model the probability that a particular bottlenose dolphin group was of the coastal morphotype as a function of environmental variables including depth, sea surface temperature and distance from shore. These models were used to partition the bottlenose dolphin groups observed during aerial surveys between the two morphotypes (Garrison *et al.* 2003).

The genetic results and spatial patterns observed in aerial surveys indicate both regional and seasonal differences in the longitudinal distribution of the two morphotypes in coastal Atlantic waters. During summer months, all biopsy samples collected from ~~nearshore~~coastal waters north of Cape Lookout, North Carolina (<20 m deep) were of the coastal morphotype, and all samples collected in deeper waters (>40 m deep) were of the offshore morphotype. South of Cape Lookout, the probability of an observed bottlenose dolphin group being of the coastal morphotype declined with increasing depth. In intermediate depth waters, there was spatial overlap between the two morphotypes. Offshore morphotype bottlenose dolphins were observed at depths as shallow as 13 m, and coastal morphotype dolphins were observed at depths of 31 m and 75 km from shore (Garrison *et al*. 2003).

Winter samples were collected primarily from ~~nearshore~~coastal waters in North Carolina and Georgia~~.~~ and ~~T~~the vast majority of ~~samples collected in nearshore waters of North Carolina during winter~~them were of the coastal morphotype; however, one offshore morphotype group was sampled during November just south of Cape Lookout only 7.3 km from shore. Coastal morphotype samples were also collected farther away from shore at 33 m depth and 39 km ~~distance~~ from shore. The logistic regression model for this region indicated a decline in the probability of a

coastal morphotype group with increasing distance from shore; however, the model predictions were highly uncertain due to limited sample sizes and spatial overlap between the two morphotypes. Samples collected in Georgia waters also indicated significant overlap between the two morphotypes with a declining probability of the coastal morphotype with increasing depth. A coastal morphotype sample was collected 112 km from shore at a depth of 38 m. An offshore sample was collected in 22 m depth at 40 km from shore. As with the North Carolina model, the Georgia logistic regression predictions are uncertain due to limited sample size and high overlap between the two morphotypes (Garrison *et al.* 2003).

In summary, the primary habitat of the coastal morphotype of bottlenose dolphin extends from Florida to New Jersey during summer months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype occurs in lower densities over the continental shelf (waters between 20 m and 100 m depth) and overlaps spatially with the offshore morphotype.

Distinction between Coastal and Estuarine Bottlenose Dolphins

~~In addition to inhabiting coastal nearshore waters, t~~The coastal morphotype of bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Scott *et al.* 1990; Wells *et al.* 1996; Weller 1998; Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Balmer *et al.* 2008; Mazzoil *et al.* 2008). There are multiple lines of evidence supporting demographic separation between bottlenose dolphins residing within estuaries along the Atlantic coast. For example, long-term photo-identification (photo-ID) studies in waters around Charleston, South Carolina, have identified communities of resident dolphins that are seen within relatively restricted home ranges year-round (Zolman 2002; Speakman *et al.* 2006). In Biscayne Bay, Florida, there is a similar community of bottlenose dolphins with evidence of year-round residents that are genetically distinct from animals residing in a nearby estuary in Florida Bay (Litz *et al.* 2012~~07~~). A long-term photo-ID study in the Indian River Lagoon system in central Florida has also identified year-round resident dolphins repeatedly observed across multiple years (Stolen *et al.* 2007; Mazzoil *et al.* 2008).

A few published studies demonstrate that these resident animals are genetically distinct from animals in nearby coastal waters. A study conducted near Jacksonville, Florida, demonstrated significant genetic differences between animals in ~~nearshore~~ coastal ~~waters~~ and estuarine waters (Caldwell 2001; Rosel *et al*. 2009) and animals resident in the Charleston estuarine system show significant genetic differentiation from animals biopsied in coastal waters of southern Georgia (Rosel *et al*. 2009). ~~In addition, stable isotope ratios of~~ ^{18}~~O relative to~~ ^{16}~~O (referred to as depleted~~ ^{18}~~O or depleted oxygen) in animals sampled along the Outer Banks of North Carolina between Cape Hatteras and Bogue Inlet during February and March were very low (Cortese 2000). One explanation for this depleted oxygen signature is that a resident group of dolphins in Pamlico Sound moves into nearby nearshore areas in the winter.~~

Despite evidence for genetic differentiation between estuarine and ~~nearshore~~coastal populations, the degree of spatial overlap between these populations remains unclear. Photo-ID studies within estuaries demonstrate seasonal immigration and emigration and the presence of transient animals (e.g., Speakman *et al*. 2006). In addition, the degree of movement of resident estuarine animals into coastal waters on seasonal or shorter time scales is poorly understood. However, for the purposes of this analysis, bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct from those inhabiting coastal habitats. Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.

Definition of the South Carolina/Georgia Coastal Stock

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in strandings during a large scale mortality event occurring during 1987-1988 (Scott *et al.* 1988). However, re-analysis of stranding data (McLellan *et al.* 2003) and extensive analysis of genetic (Rosel *et al.* 2009), photo-ID (Zolman 2002) and satellite telemetry (Hohn and Hansen, NMFS unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are 5 coastal stocks of bottlenose dolphins: the Northern Migratory and Southern Migratory ~~s~~Stocks, a South Carolina/Georgia Coastal ~~s~~Stock, a Northern Florida Coastal ~~s~~Stock and a Central Florida Coastal ~~s~~Stock.

The spatial extent of these stocks, their potential seasonal movements, and their relationships with estuarine stocks are poorly understood. Migratory movement and spatial distribution of the Northern Migratory ~~s~~Stock is best understood based on tag-telemetry, photo-ID and aerial survey data. This stock migrates seasonally between coastal

waters of central North Carolina and New Jersey. It is not thought to overlap with the South Carolina/Georgia Coastal ~~s~~Stock in any season. The Southern Migratory ~~s~~Stock is defined primarily on satellite tag telemetry studies and is thought to migrate south from waters of southern Virginia and north central North Carolina in the summer to waters south of Cape Fear and as far south as coastal Florida during winter months.

During summer months when the Southern Migratory ~~s~~Stock is found in waters north of Cape Fear, North Carolina, bottlenose dolphins are still seen in coastal waters of South Carolina, Georgia and Florida, indicating the presence of additional stocks of coastal animals. Speakman *et al*. (2006) using photo-ID studies documented dolphins in coastal waters off Charleston, South Carolina, that are not known resident members of the estuarine stock. Genetic analyses of samples from northern Florida, Georgia and central South Carolina (primarily the estuaries around Charleston), using both mitochondrial DNA and nuclear microsatellite markers, indicate significant genetic differences between these areas (NMFS 2001; Rosel *et al*. 2009). This stock assessment report addresses the South Carolina/Georgia Coastal ~~s~~Stock, which is present in coastal Atlantic waters from the North Carolina/South Carolina border south to the Georgia/Florida border (Figure 1). There is no obvious boundary defining the offshore extent of this stock. The combined genetic and logistic regression analysis (Garrison *et al.* 2003~~2007~~) indicated that in waters less than 10 m depth, 70% of the bottlenose dolphins were of the coastal morphotype. Between 10 and 20 m depth, the percentage of animals of the coastal morphotype dropped precipitously and at depths >40 m nearly all (>90%) animals were of the offshore morphotype. However, in winter months, the Southern Migratory ~~s~~Stock (also of the coastal morphotype) moves into this region in waters 10-30 m depth complicating the ability to define ocean-side boundaries for the South Carolina/Georgia Coastal ~~s~~Stock.

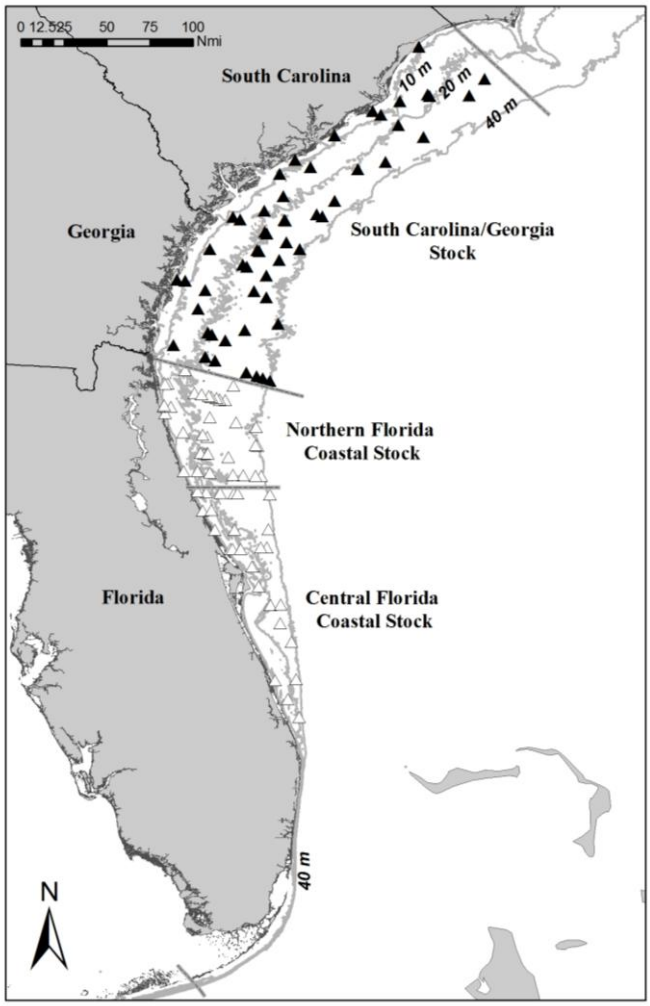

Figure 1. *The South Carolina/Georgia Coastal stock of bottlenose dolphins (North Carolina/South Carolina border to the Georgia/Florida border). ~~Circles~~ Symbols represent all sightings of bottlenose dolphin groups from NMFS ~~2002~~ 2010 and 2011~~04~~ aerial surveys; dark ~~circles~~symbols- groups within the boundaries of this stock. In waters >20 m, sightings may include the offshore morphotype of bottlenose dolphins.*

POPULATION SIZE

The best available estimate for the South Carolina/Georgia Coastal Stock of bottlenose dolphins in the western North Atlantic is 4,377 (CV=0.43; Table 1). This estimate is from aerial surveys conducted during the summers of 2010 and 2011 covering waters from Florida to New Jersey.

Earlier abundance estimates

Earlier abundance estimates for the South Carolina/Georgia Coastal stock were derived from aerial surveys conducted during the summer of 2002 and 2004. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. These surveys employed two observer teams operating independently on

the same aircraft to estimate visibility bias. In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. Observed bottlenose dolphin groups from these were partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003). The previous best abundance estimate was based upon a weighted average of the estimates from the 2002 and 2004 aerial surveys. This estimate was 7,738 (CV=0.23).

Recent surveys and abundance estimates

~~Summer 2002 and 2004Georgia/Florida border to South Carolina/North Carolina border7,7380.23Summer 2010 and 2011Georgia/Florida border to South Carolina/North Carolina border4,3770.43Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. Survey effort was also stratified to optimize coverage in seasonal management units. The surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias.~~

~~The winter 2002 survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay. A total of 6,411 km of trackline was completed during the survey, and 185 bottlenose dolphin groups were sighted including 2,114 individual animals. No bottlenose dolphins were sighted north of Chesapeake Bay where water temperatures were <9.5ºC. During the summer survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia/Florida state line. A total of 185 bottlenose dolphin groups were sighted during summer including 2,544 individual animals.~~

~~In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were 140 sightings of bottlenose dolphins including 3,093 individual animals. A winter survey was conducted between 30 January and 9 March 2005 covering waters from the mouth of Chesapeake Bay through central Florida. The survey covered 5,457km of trackline and observed 135 bottlenose dolphin groups accounting for 957 individual animals.~~

~~Abundance estimates for bottlenose dolphins in each stock were calculated using line transect methods and distance analysis (Buckland *et al.* 2001). The 2002 surveys included two teams of observers to derive a correction for visibility bias. The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct-duplicate estimator (Palka 1995). The resulting estimate of the probability of seeing animals on the trackline was applied to abundance estimates for the summer 2004 and winter 2005 surveys. Observed bottlenose dolphin groups were also partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003).~~

~~There is apparent inter-annual variation in the abundance estimates and observed spatial distribution of bottlenose dolphins in this region that may indicate movements of animals in response to environmental variability. However, at this time there is no tag telemetry or genetic evidence supporting the presence of additional migratory stocks along the southern portion of the survey range.~~

~~For the South Carolina/Georgia Coastal sStock, the mean of the summer 2002 and 2004 abundance estimates provided the best estimate of abundance. During winter months, this stock overlaps spatially with the Southern Migratory sStock and hence winter survey data are inappropriate for estimating abundance of the South Carolina/Georgia Coastal sStock. The abundance estimate for this stock from the summer 2002 survey was 8,518 (CV=0.37) and that from summer 2004 was 7,379 (CV=0.29). The best abundance estimate is the inverse variance weighted average of these two surveys and is 7,738 (CV=0.23).~~

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters along the U.S. East Coast from southeastern Florida to Cape May, New Jersey, during the summers of 2010 and 2011. The surveys were conducted along tracklines oriented perpendicular to the shoreline that were latitudinally spaced 20 km apart and covered waters from the shoreline to the continental shelf break. The summer 2010 survey was conducted during 24

July–14 August 2010, and 7,944 km of on-effort tracklines completed. A total of 127 bottlenose dolphin groups were observed including 1,541 animals. During the 2011 summer survey, 8,665 km of trackline were completed between Cape May, New Jersey and Ft. Pierce, Florida. The survey was conducted during 6 July - 29 July 2011. The 2011 survey also included more closely spaced "fine-scale" tracklines in waters offshore of New Jersey and Virginia within areas being evaluated for the placement of offshore energy installations. A total of 112 bottlenose dolphin groups were sighted including 1,339 animals.

Both the summer 2010 and 2011 surveys were conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake *et al.* 2004). However, the detection functions from both surveys indicated a decreased probability of detection near the trackline, which limited the effectiveness of the method for correcting for visibility bias due to a relatively small number of sightings made by both teams near the trackline. Abundance estimates were therefore derived by combining the sightings from both teams during a survey and "left-truncating" the data by analyzing only sightings occurring greater than 100 m from the trackline during the 2010 survey and 50 m during the 2011 survey (Buckland *et al.* 2001). Detection functions were fit to these left-truncated data accounting for the effects of survey conditions (e.g., sea state, glare, water color) on the detection probabilities. A logistic regression model was used to estimate the probability that a given group of dolphins observed during the aerial survey was of the coastal vs. offshore morphotype as a function of water depth (Garrison *et al.* 2003). This probability was incorporated into the abundance estimation to derive an estimate of coastal morphotype dolphins observed during the 2010 and 2011 aerial surveys. A bootstrap resampling approach was used to estimate the variance of the estimates. The resulting abundance estimates assume that detection probability at the truncation distance is equal to 1. While the estimates could not be explicitly corrected for this assumption, analyses of the summer 2010 data suggest that this bias is likely small.

The abundance estimates for the South Carolina/Georgia Coastal Stock were based upon tracklines and sightings occurring between the North Carolina/South Carolina border and the Georgia/Florida border and in waters from the shoreline to the 40-m isobath. The abundance estimate derived from the summer 2010 survey was 6,350 (CV=0.53), and the estimate from the summer 2011 survey was 2,160 (CV=0.59). The best estimate is a weighted average of these two with higher weighting given to the more precise estimate from 2010. The resulting best estimate is 4,377 (CV=0.43).

Table 1. Summary of abundance estimates for the western North Atlantic South Carolina/Georgia Coastal Stock of bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Summer 2002 and 2004	Georgia/Florida border to South Carolina/North Carolina border	7,738	0.23
Summer 2010 and 2011	Georgia/Florida border to South Carolina/North Carolina border	4,377	0.43

Minimum Population Estimate

The minimum population size (Nmin) for the stock was calculated as the lower bound of the 60% confidence interval for a log-normally distributed mean (Wade and Angliss 1997). The best estimate for the South Carolina/Georgia Coastal ~~s~~Stock is ~~7,738~~ 4,377 (CV=~~0.23~~0.43). The resulting minimum population estimate is ~~6,399~~ 3,097.

Current Population Trend

There are limited data available to assess population trends for this stock. The estimates from the 2002/2004 and 2010/2011 surveys are not significantly different from each other; however, it should be noted that the relatively large CVs limit the power to detect significant differences. The statistical power to detect a trend in abundance for this species is poor due to the relatively imprecise estimates and long survey interval. For example, the power to detect a precipitous decline (i.e., 50% decrease in 15 years) in abundance with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).
~~There are insufficient data to determine the population trends for this stock.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the western North Atlantic coastal morphotype. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the South Carolina/Georgia Coastal ~~s~~Stock of bottlenose dolphins is ~~6,272~~ 3,097. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is depleted. PBR for this stock of bottlenose dolphins is ~~64~~ 31.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the South Carolina/Georgia Coastal Stock Stock during 2007-2011 is unknown. There were 4 dolphins either recovered dead with fishing gear attached and/or observed dead in fishing gear. Two of the dead dolphins had hook/line gear entanglements/ingestions; 1 had commercial blue crab pot gear attached; and 1 was an observed take in a cannonball jellyfish trawl fishery. These represent minimum known counts of fishery-caused mortality and serious injury.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al.* 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

~~Three~~Four Category II fisheries have the potential to interact with the South Carolina/Georgia Coastal ~~s~~Stock of bottlenose dolphins – the Southeastern U.S. Atlantic shark gillnet fishery, the Southeast Atlantic gillnet fishery, the Southeastern U.S. Atlantic shrimp trawl fishery and the Atlantic blue crab/trap pot fishery. ~~In addition, the Southeastern U.S. Atlantic shrimp trawl fishery (Category III) has the potential to interact with this stock.~~ Two Category III fisheries have the potential to interact with this stock: the Georgia cannonball jellyfish trawl fishery and the Atlantic Ocean commercial passenger fishing vessel (hook and line) fishery. Only limited observer data are available for these and other fisheries that may interact with this stock. Therefore, the total average annual mortality estimate is a lower bound of the actual annual human-caused mortality for each stock. Detailed fishery information is presented in Appendix III.

Southeastern U.S. Atlantic Shark Gillnet Fishery and Southeast Atlantic Gillnet Fishery

Gillnet fisheries targeting finfish and sharks operate in southeast waters between North Carolina and southern Florida. These fisheries include a number of different fishing methods and gear types including drift nets, "strike" fishing, and anchored ("sink") gillnets. The majority of this fishing is reported from waters of North Carolina and central Florida. A small number of trips ~~(average 35 annually from 2004-2008)~~ are reported annually within the bounds of the South Carolina/Georgia Coastal ~~s~~Stock. There has been ~~no~~occasional observer coverage of sets within the stock boundaries.~~, and therefore there have been no observed~~No takes have been observed.

Southeastern U.S. Shrimp Trawl Fishery

In ~~August~~ 2002 in Beaufort County, South Carolina, a fisherman self-reported a dolphin entanglement in a commercial shrimp trawl. In 2006 in Beaufort County, South Carolina, a dolphin was incidentally taken in a shrimp trawl during fishery trawl research. No other bottlenose dolphin mortality or serious injury has been reported to NMFS. There has been very little systematic observer coverage of this fishery during the last decade.

Atlantic Blue Crab/Trap Pot Fishery

The blue crab trap pot fishery only rarely fishes in coastal waters of South Carolina and Georgia during winter months. Thus coastal dolphins rarely have the opportunity to encounter trap pots. ~~During 2004-2008, no stranded animals assigned to the South Carolina/Georgia Coastal stock showed evidence of entanglement in trap pot gear.~~However, during 2007-2011, 1 stranded carcass was found entangled around its peduncle in commercial blue crab pot, line and buoy gear. Two additional strandings had rope abrasions at the insertion of flukes and on their peduncles consistent with crab pot entanglement, but no gear was present to confirm.

Georgia Cannonball Jellyfish Trawl Fishery

During 2007-2011, 1 bottlenose dolphin was incidentally captured by a commercial fishing vessel trawling for cannonball jellyfish. This mortality occurred during 2011 several miles off the Georgia coast.

Hook and Line Fisheries

During 2007-2011, 2 dolphins were documented with ingested hook and line gear. During 2010 in the South Carolina/Georgia Coastal Stock area, 1 dolphin was documented with ingested recreational sportfishery gear wrapped around its goosebeak. In 2011 an additional animal was documented with ingested hook and line gear. These mortalities were included in the stranding database.

Other Mortality

~~There were 128 stranded bottlenose dolphins recovered between 2004 and 2008 in the waters of the South Carolina/Georgia Coastal stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). It was not possible to determine whether or not there was evidence of human interaction for 75 of these strandings and for 48 it was determined there was no evidence of human interaction. The remaining five showed evidence of human interaction and one of those showed evidence of fishery interaction- an animal was found in 2005 with hook and line in the mouth. Two animals had lacerations, again unknown whether ante mortem or post mortem, and one had human debris in the forestomach. Finally, one of the six animals with human interaction determinations was caught in a research trawl in 2006, although it is unknown whether the animal was dead prior to being caught in the trawl. It is worth noting that during winter months, the South Carolina/Georgia Coastal stock overlaps with the Southern Migratory stock and it is currently not possible to distinguish between them. Hence during winter months, stranded dolphins could come from either of these two stocks.~~There were 149 stranded bottlenose dolphins documented between 2007 and 2011 in the waters of the South Carolina/Georgia Coastal Stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). It was not possible to determine whether or not there was evidence of human interaction for 86 of these strandings, and for 50 it was determined there was no evidence of human interaction. The remaining 13 showed evidence of human interactions, including 6 fishery interactions, 2 mutilations, 2 cases of live stranded animals being carried to deeper water by the public, and 3 cases of wounds and line impressions of unknown origin. As mentioned above, 1 of the fishery interactions was a carcass found entangled in commercial blue crab pot gear. Two other fishery interactions had rope abrasions consistent with crab pot entanglement, but no gear was present to confirm. Two fishery interactions consisted of ingested hook and line gear, wrapped around the goosebeak in one case and found in the animal's stomach in the second case. It is worth noting that during winter months, the South Carolina/Georgia Coastal Stock overlaps with the Southern Migratory Coastal Stock and it is currently not possible to distinguish between them. Hence during winter months, stranded dolphins could come from either of these two stocks. Some (42) of the 149 strandings are also included in the stranding total for the Southern Migratory Coastal Stock.

An Unusual Mortality Event (UME) was declared in South Carolina during February-May 2011. Fourteen strandings assigned to the South Carolina/Georgia Coastal Stock were considered to be part of the UME. The cause of this UME is still under investigation.

The nearshore and estuarine habitats occupied by the coastal morphotype are adjacent to areas of high human population and some are highly industrialized. The blubber of stranded dolphins examined during the 1987-1988 mortality event contained very high concentrations of organic pollutants (Kuehl *et al*. 1991). More recent studies have examined persistent organic pollutant concentrations in bottlenose dolphin inhabiting estuaries along the Atlantic coast and have likewise found evidence of high blubber concentrations particularly near Charleston, South

Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCK

Bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, but the South Carolina/Georgia Coastal Stock is a strategic stock due to the depleted listing under the Marine Mammal Protection Act~~MMPA~~. From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units and again in 2008 and 2010 to recognize resident estuarine stocks and migratory and resident coastal stocks. This stock retains the depleted designation as a result of its origins from the originally delineated depleted coastal migratory stock. PBR for the South Carolina/Georgia Coastal Stock is 31 and so the zero mortality rate goal, 10% of PBR, is 3.1. The documented annual average of human-caused mortality for this stock for 2007 – 2011 ranges from 0.8 to 1.2. However, there are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. Insufficient information is available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine population trends for this stock.~~The total U.S. fishery-related mortality and serious injury for the South Carolina/Georgia Coastal stock is unknown. There are several commercial fisheries overlapping with the stock boundaries; however, these have little to no observer coverage. Insufficient information is available to determine whether the total fishery mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The species is not listed as threatened or endangered under the Endangered Species Act, but this is a strategic stock due to the depleted listing under the MMPA.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic Northern Florida Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Geographic Range and Coastal Morphotype Habitat

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula and ~~along~~into the Gulf of Mexico~~ coast~~. Based on differences in mitochondrial DNA haplotype frequencies, nearshore animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Duffield and Wells 2002; Rosel *et al.* 2009). On the Atlantic coast, Scott *et al.* (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-1988 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks residing in coastal waters of the western North Atlantic (McLellan *et al.* 2003; Rosel *et al.* 2009).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype ~~primarily occupying~~that occupies habitats further offshore (Mead and Potter 1995; Hoelzel *et al.* 1998; Rosel *et al.* 2009). Aerial surveys conducted between 1978 and 1982 (CETAP 1982) north of Cape Hatteras, North Carolina, identified two concentrations of bottlenose dolphins, one ~~inshore of~~near the coast within the 25-m isobath and the other offshore of the 50-m isobath and concentrated at the continental shelf edge. The lowest density of bottlenose dolphins was observed over the continental shelf~~, with higher densities along the coast and near the continental shelf edge~~. It was suggested, therefore, that north of Cape Hatteras, North Carolina, the coastal morphotype is restricted to waters <25 m deep (Kenney 1990). Similar patterns were observed during summer months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al.* 2003). However, south of Cape Hatteras during both winter and summer months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al.* 2003).

To address the question of the distribution of coastal and offshore morphotypes in waters south of Cape Hatteras, tissue samples were collected in coastal, shelf and slope waters from New England to Florida between 1997 and 2006. ~~during large vessel surveys during the summers of 1998 and 1999, during systematic biopsy sampling efforts in nearshore waters from New Jersey to central Florida conducted in the summers of 2001 and 2002, and during winter biopsy collection efforts in 2002 and 2003, in nearshore continental shelf waters of North Carolina and Georgia. Additional biopsy samples were collected in deeper continental shelf waters south of Cape Hatteras during winter 2002.~~ Genetic analyses using mitochondrial DNA sequences of these biopsies identified individual animals to the coastal or offshore morphotype. Using the genetic results from all surveys combined, a logistic regression was used to model the probability that a particular bottlenose dolphin group was of the coastal morphotype as a function of environmental variables including depth, sea surface temperature and distance from shore. These models were used to partition the bottlenose dolphin groups observed during aerial surveys between the two morphotypes (Garrison *et al.* 2003).

The genetic results and spatial patterns observed in aerial surveys indicate both regional and seasonal differences in the longitudinal distribution of the two morphotypes in coastal Atlantic waters. During summer months, all biopsy samples collected from ~~nearshore~~coastal waters north of Cape Lookout, North Carolina (<20 m deep) were of the coastal morphotype, and all samples collected in deeper waters (>40 m deep) were of the offshore morphotype. South of Cape Lookout, the probability of an observed bottlenose dolphin group being of the coastal morphotype declined with increasing depth. In intermediate depth waters, there was spatial overlap between the two morphotypes. Offshore morphotype bottlenose dolphins were observed at depths as shallow as 13 m, and coastal morphotype dolphins were observed at depths of 31 m and 75 km from shore (Garrison *et al*. 2003).

Winter samples were collected primarily from ~~nearshore~~coastal waters in North Carolina and Georgia~~.~~ and ~~T~~the vast majority of ~~samples collected in nearshore waters of North Carolina during winter~~them were of the coastal morphotype; however, one offshore morphotype group was sampled during November just south of Cape Lookout only 7.3 km from shore. Coastal morphotype samples were also collected farther away from shore at 33 m depth and

39 km ~~distance~~ from shore. The logistic regression model for this region indicated a decline in the probability of a coastal morphotype group with increasing distance from shore; however, the model predictions were highly uncertain due to limited sample sizes and spatial overlap between the two morphotypes. Samples collected in Georgia waters also indicated significant overlap between the two morphotypes with a declining probability of the coastal morphotype with increasing depth. A coastal morphotype sample was collected 112 km from shore at a depth of 38 m. An offshore sample was collected in 22 m depth at 40 km from shore. As with the North Carolina model, the Georgia logistic regression predictions are uncertain due to limited sample size and high overlap between the two morphotypes (Garrison *et al.* 2003).

In summary, the primary habitat of the coastal morphotype of bottlenose dolphin extends from Florida to New Jersey during summer months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype occurs in lower densities over the continental shelf (waters between 20 m and 100 m depth) and overlaps spatially with the offshore morphotype.

Distinction between Coastal and Estuarine Bottlenose Dolphins

In addition to inhabiting coastal nearshore waters, ~~t~~The coastal morphotype of bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Scott *et al.* 1990; Wells *et al.* 1996; Weller 1998; Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Balmer *et al.* 2008; Mazzoil *et al.* 2008). There are multiple lines of evidence supporting demographic separation between bottlenose dolphins residing within estuaries along the Atlantic coast. For example, long-term photo-identification (photo-ID) studies in waters around Charleston, South Carolina, have identified communities of resident dolphins that are seen within relatively restricted home ranges year-round (Zolman 2002; Speakman *et al.* 2006). In Biscayne Bay, Florida, there is a similar community of bottlenose dolphins with evidence of year-round residents that are genetically distinct from animals residing in a nearby estuary in Florida Bay (Litz *et al.* 2012~~07~~). A long-term photo-ID study in the Indian River Lagoon system in central Florida has also identified year-round resident dolphins repeatedly observed across multiple years (Stolen *et al.* 2007; Mazzoil *et al.* 2008).

A few published studies demonstrate that these resident animals are genetically distinct from animals in nearby coastal waters. A study conducted near Jacksonville, Florida, demonstrated significant genetic differences between animals in ~~nearshore~~ coastal ~~waters~~ and estuarine waters (Caldwell 2001; Rosel *et al*. 2009) and animals resident in the Charleston estuarine system show significant genetic differentiation from animals biopsied in coastal waters of southern Georgia (Rosel *et al*. 2009). ~~In addition, stable isotope ratios of~~ ^{18}~~O relative to~~ ^{16}~~O (referred to as depleted~~ ^{18}~~O or depleted oxygen) in animals sampled along the Outer Banks of North Carolina between Cape Hatteras and Bogue Inlet during February and March were very low (Cortese 2000). One explanation for this depleted oxygen signature is that a resident group of dolphins in Pamlico Sound moves into nearby nearshore areas in the winter.~~

Despite evidence for genetic differentiation between estuarine and ~~nearshore~~coastal populations, the degree of spatial overlap between these populations remains unclear. Photo-ID studies within estuaries demonstrate seasonal immigration and emigration and the presence of transient animals (e.g., Speakman *et al*. 2006). In addition, the degree of movement of resident estuarine animals into coastal waters on seasonal or shorter time scales is poorly understood. However, for the purposes of this analysis, bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct from those inhabiting coastal habitats. Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.

Definition of the Northern Florida Coastal Stock

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in strandings during a large scale mortality event occurring during 1987-1988 (Scott *et al.* 1988). However, re-analysis of stranding data (McLellan *et al.* 2003) and extensive analysis of genetic (Rosel *et al.* 2009), photo-ID (Zolman 2002) and satellite telemetry (Hansen and Hohn, NMFS unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are five coastal stocks of bottlenose dolphins: the Northern Migratory and Southern Migratory ~~s~~Stocks, a South Carolina/Georgia Coastal ~~s~~Stock, a Northern Florida Coastal ~~s~~Stock and a Central Florida Coastal ~~s~~Stock.

The spatial extent of these stocks, their potential seasonal movements, and their relationships with estuarine stocks are poorly understood. Migratory movement and spatial distribution of the Northern Migratory ~~s~~Stock is best understood based on tag-telemetry, photo-ID and aerial survey data and migrates seasonally between coastal waters of central North Carolina and New Jersey. It is not thought to overlap with the South Carolina/Georgia Coastal Stock in any season. The Southern Migratory ~~s~~Stock is defined primarily on satellite tag telemetry studies and is thought to migrate south from waters of southern Virginia and north central North Carolina in the summer to waters south of Cape Fear and as far south as coastal Florida during winter months. While it is possible that this stock overlaps during winter with the northern range of the Northern Florida Coastal ~~s~~Stock, more data are needed to confirm this overlap.

During summer months when the Southern Migratory ~~s~~Stock is found in waters north of Cape Fear, North Carolina, bottlenose dolphins are still seen in coastal waters of South Carolina, Georgia and Florida, indicating the presence of additional stocks of coastal animals. Speakman *et al.* (2006) using photo-ID studies documented dolphins in coastal waters off Charleston, South Carolina, that are not known resident members of the estuarine stock. Genetic analyses of samples from northern Florida, Georgia and central South Carolina (primarily the estuaries around Charleston), using both mitochondrial DNA and nuclear microsatellite markers, indicate significant genetic differences between these areas (NMFS 2001; Rosel *et al*. 2009). This stock assessment report addresses the Northern Florida Coastal Stock, which is present in coastal Atlantic waters from the Georgia/Florida border south to 29.4°N (Figure 1). There is no obvious boundary defining the offshore extent of this stock. The combined genetic and logistic regression analysis (Garrison *et al.* 2003) indicated that in waters less than 10 m depth, 70% of the bottlenose dolphins were of the coastal morphotype. Between 10 and 20 m depth, the percentage of animals of the coastal morphotype dropped precipitously and at depths >40 m nearly all (>90%) animals were of the offshore morphotype. However, in winter months, the Southern Migratory ~~s~~Stock ~~(also of the coastal morphotype)~~ moves into this region in waters 10-30 m depth complicating the ability to define ocean-side boundaries for the Northern Florida Coastal ~~s~~Stock.

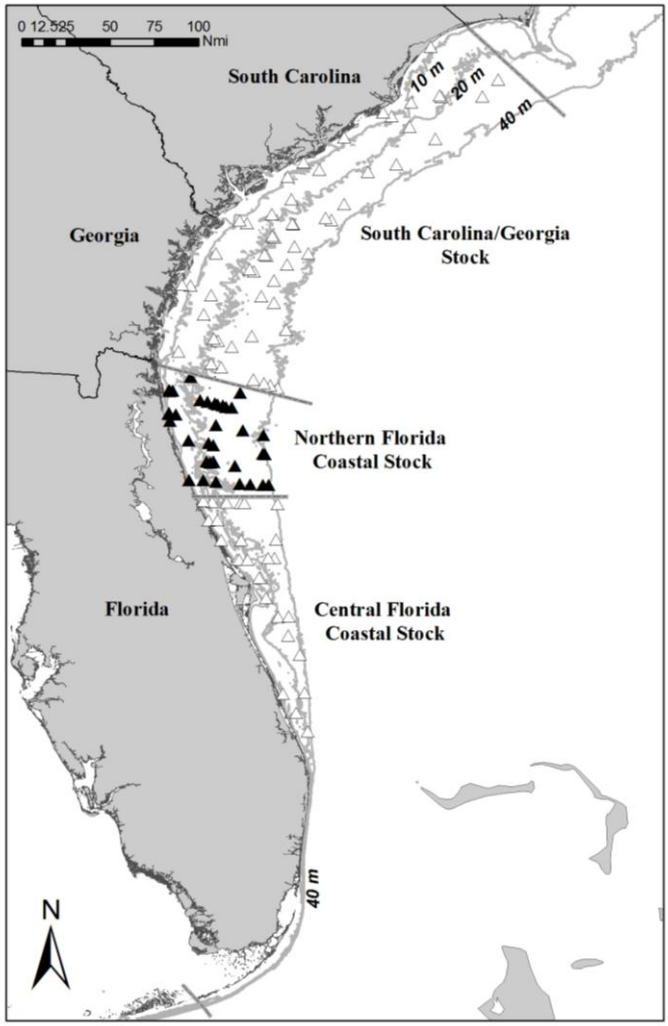

Figure 1. *The Northern Florida Coastal ~~s~~Stock of bottlenose dolphins (Georgia/Florida border to 29.4°N). ~~Circles~~ Symbols represent all sightings of bottlenose dolphin groups from NMFS ~~2002~~ 2010 and ~~2004~~ 2011 aerial surveys; dark ~~circles~~symbols- groups within the boundaries of this stock. In waters > 20 m, sightings may include the offshore morphotype of bottlenose dolphins.*

POPULATION SIZE

The best available estimate for the Northern Florida Coastal Stock of bottlenose dolphins in the western North Atlantic is 1,219 (CV=0.67; Table 1). This estimate is from aerial surveys conducted during the summers of 2010 and 2011 covering waters from Florida to New Jersey.

Earlier abundance estimates

Earlier abundance estimates for the Northern Florida Coastal stock were derived from aerial surveys conducted during the summer of 2002 and 2004. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. These surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias. In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. Observed bottlenose dolphin groups from these were partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al*. 2003). The previous best abundance estimate was based upon an average of the estimates from the 2002 and 2004 aerial surveys. This estimate was 3,064 (CV=0.24).

Recent surveys and abundance estimates

~~Summer 2002 and 2004Georgia/Florida border to 29.4°N latitude3,0640.24Summer 2010 and 2011Georgia/Florida border to 29.4°N latitude1,2190.67Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. Survey effort was also stratified to optimize coverage in seasonal management units. The surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias.~~

~~The winter 2002 survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay. A total of 6,411km of trackline was completed during the survey, and 185 bottlenose dolphin groups were sighted including 2,114 individual animals. No bottlenose dolphins were sighted north of Chesapeake Bay where water temperatures were <9.5ºC. During the summer survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia/Florida state line. A total of 185 bottlenose dolphin groups was sighted during summer including 2,544 individual animals.~~

~~In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were 140 sightings of bottlenose dolphins including 3,093 individual animals. A winter survey was conducted between 30 January and 9 March 2005 covering waters from the mouth of Chesapeake Bay through central Florida. The survey covered 5,457 km of trackline and observed 135 bottlenose dolphin groups accounting for 957 individual animals.~~

~~Abundance estimates for bottlenose dolphins in each stock were calculated using line transect methods and distance analysis (Buckland *et al*. 2001). The 2002 surveys included two teams of observers to derive a correction for visibility bias. The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct duplicate estimator (Palka 1995). The resulting estimate of the probability of seeing animals on the trackline was applied to abundance estimates for the summer 2004 and winter 2005 surveys. Observed bottlenose dolphin groups were also partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al*. 2003).~~

~~For the Northern Florida Coastal s~~Stock, ~~the mean of the summer 2002 and 2004 abundance estimates provided the best estimate of abundance. During winter months, this stock overlaps spatially with the Southern Migratory s~~Stock, ~~and hence winter survey data are inappropriate for estimating abundance. There is strong inter-annual variation in the abundance estimates and observed spatial distribution of bottlenose dolphins in this region that may indicate movements of animals in response to environmental variability. The abundance estimate for this stock from the summer 2002 survey was 737 (CV=0.47) and that from summer 2004 was 5,391 (CV=0.27). The best abundance estimate is the unweighted average of these 2 surveys and is 3,064 (CV=0.24). It is unknown why the abundance estimates from 2002 and 2004 differ by nearly an order of magnitude. Survey methodologies did not differ significantly between the years, although a larger amount of survey effort was expended in the Northern Florida and Central Florida strata during 2004 than in 2002. The disparity most likely represents variability in dolphin spatial distribution between those 2 years. Because the 2 abundance estimates differ so dramatically, using an inverse-variance weighted mean when combining the estimates would heavily weight the smaller of the 2 estimates, and~~

~~therefore would likely introduce negative bias into the estimate of stock size. Therefore, an unweighted mean of the 2002 and 2004 abundance estimates was calculated and used as the best estimate of stock abundance.~~

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters along the U.S. East Coast from southeastern Florida to Cape May, New Jersey, during the summers of 2010 and 2011. The surveys were conducted along tracklines oriented perpendicular to the shoreline that were latitudinally spaced 20 km apart and covered waters from the shoreline to the continental shelf break. The summer 2010 survey was conducted during 24 July–14 August 2010, and 7,944 km of on-effort tracklines completed. A total of 127 bottlenose dolphin groups were observed including 1,541 animals. During the 2011 summer survey, 8,665 km of trackline were completed between Cape May, New Jersey and Ft. Pierce, Florida. The survey was conducted during 6 July - 29 July 2011. The 2011 survey also included more closely spaced "fine-scale" tracklines in waters offshore of New Jersey and Virginia within areas being evaluated for the placement of offshore energy installations. A total of 112 bottlenose dolphin groups were sighted including 1,339 animals.

Both the summer 2010 and 2011 surveys were conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake *et al.* 2004). However, the detection functions from both surveys indicated a decreased probability of detection near the trackline, which limited the effectiveness of the method for correcting for visibility bias due to a relatively small number of sightings made by both teams near the trackline. Abundance estimates were therefore derived by combining the sightings from both teams during a survey and "left-truncating" the data by analyzing only sightings occurring greater than 100 m from the trackline during the 2010 survey and 50 m during the 2011 survey (Buckland *et al.* 2001). Detection functions were fit to these left-truncated data accounting for the effects of survey conditions (e.g., sea state, glare, water color) on the detection probabilities. A logistic regression model was used to estimate the probability that a given group of dolphins observed during the aerial survey was of the coastal vs. offshore morphotype as a function of water depth (Garrison *et al.* 2003). This probability was incorporated into the abundance estimation to derive an estimate of coastal morphotype dolphins observed during the 2010 and 2011 aerial surveys. A bootstrap resampling approach was used to estimate the variance of the estimates. The resulting abundance estimates assume that detection probability at the truncation distance is equal to 1. While the estimates could not be explicitly corrected for this assumption, analyses of the summer 2010 data suggest that this bias is likely small.

The abundance estimates for the Northern Florida Coastal Stock were based upon tracklines and sightings occurring between the Georgia/Florida border and 29.4°N latitude and in waters from the shoreline to the 40-m isobath. The abundance estimate derived from the summer 2010 survey was 751 (CV=0.83), and the estimate from the summer 2011 survey was 1,730 (CV=0.90). The best estimate is a weighted average of these two with higher weighting given to the more precise estimate from 2010. The resulting best estimate is 1,219 (CV=0.67).

Table 1. Summary of abundance estimates for the western North Atlantic Northern Florida Coastal Stock of bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Summer 2002 and 2004	Georgia/Florida border to 29.4°N latitude	3,064	0.24
Summer 2010 and 2011	Georgia/Florida border to 29.4°N latitude	1,219	0.67

Minimum Population Estimate

The minimum population size (Nmin) for the stock was calculated as the lower bound of the 60% confidence interval for a log-normally distributed mean (Wade and Angliss 1997). The best estimate for the Northern Florida Coastal ~~s~~Stock is ~~3,064~~1,219 (CV=~~0.24~~0.67). The resulting minimum population estimate is ~~2,511~~730.

Current Population Trend

There are limited data available to assess population trends for this stock. The estimates from the 2002/2004 and 2010/2011 surveys are not significantly different from each other; however, it should be noted that the relatively

large CVs limit the power to detect significant differences. The statistical power to detect a trend in abundance for this species is poor due to the relatively imprecise estimates and long survey interval. For example, the power to detect a precipitous decline (i.e., 50% decrease in 15 years) in abundance with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al*. 2007).

~~There are insufficient data to determine the population trends for this stock.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the western North Atlantic coastal morphotype. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the Northern Florida Coastal ~~s~~Stock of bottlenose dolphins is ~~2,502~~ 730. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is depleted. PBR for this stock of bottlenose dolphins is ~~25~~7.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the Northern Florida Coastal Stock during 2007-2011 is unknown. There were two dolphins recovered dead with fishing gear attached. One was entangled in two blue crab traps/pots, and one had hook and line gear in its stomach. These represent minimum known counts of fishery-caused mortality and serious injury.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

~~Three~~Four Category II fisheries have the potential to interact with the Northern Florida Coastal ~~s~~Stock of bottlenose dolphins – the Southeastern U.S. Atlantic shark gillnet fishery, the Southeast Atlantic gillnet fishery, ~~and~~ the Atlantic blue crab/trap pot fishery and~~. In addition,~~ the Southeastern U.S. Atlantic shrimp trawl fishery. The Atlantic Ocean commercial passenger fishing vessel (hook and line) fishery (Category III) may also interact with this stock. Only limited observer data are available for these and other fisheries that may interact with this stock. Therefore, the total average annual mortality estimate is a lower bound of the actual annual human-caused mortality for each stock. Detailed fishery information is presented in Appendix III.

Southeastern U.S. Atlantic Shark Gillnet Fishery and Southeast Atlantic Gillnet Fishery

Gillnet fisheries targeting finfish and sharks operate in southeast waters between North Carolina and southern Florida. Historically, a drift net fishery targeting coastal sharks operated in waters including within the Northern Florida Coastal ~~s~~Stock boundaries during winter months. Bottlenose dolphin takes (n=2) in the drift net fisheries were documented in 2002 and 2003 just south of the range of the Northern Florida Coastal ~~s~~Stock (Garrison 2007). Currently, gillnet fisheries include a number of different fishing methods and gear types including drift nets, "strike" fishing, and anchored ("sink") gillnets. The majority of this fishing is reported from waters of North Carolina and central Florida. ~~Gillnet trips (average 211 annually from 2004-2008) are reported within the bounds of the Northern Florida Coastal stock.~~ There have been no observed bottlenose dolphin takes within the stock boundaries~~, but there was no observer coverage in 2008, so it was not possible to observe any takes (Table 1)~~.

~~Table 1. Summary of the 2004-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus truncatus*) by stock in the southeast gillnet fisheries in water of the Northern Florida Coastal stock. Data include years sampled (Years), number of vessels reporting effort within the fishery (Vessels), type of data used (Data Type), annual observer coverage (Observer Coverage), mortalities recorded by on-board observers (Observed Mortality), estimated annual mortality (Estimated Mortality), estimated CV of the annual mortality (Estimated CVs), and mean annual mortality (CV in parentheses).~~

~~Stock~~	~~Years~~	~~Vessels~~	~~Data Type [a]~~	~~Observer Coverage [b]~~	~~Observed Serious Injury~~	~~Observed Mortality~~	~~Estimated Mortality~~	~~Estimated CVs~~	~~Mean Annual Mortality~~
~~Northern Florida Coastal~~	~~2004-2008~~		~~Obs. Data, SEFSC FVL~~	~~0.14, 0.09, 0.02, 0.03, 0~~	~~0, 0, 0, 0, unk~~	~~0, 0, 0, 0, unk~~	~~0, 0, 0, 0, NA~~	~~NA~~	~~0* (*no observer coverage in 2008)~~

~~NA = cannot be calculated~~

~~[a] Observer data are used to estimate bycatch rates. The SEFSC Fishing Vessel Logbook (FVL) is used to estimate effort as total number of reported trips with effort inside the stock boundaries. Reported fishery effort includes a number of different fishing methods and target species that cannot be separated.~~

~~[b] Percent observer coverage is reported on a per trip basis as limited by reporting to the FVL. Multiple sets may occur on any given trip.~~

Atlantic Blue Crab~~/~~ Trap/~~-~~Pot Fishery

During ~~2004-2008~~2007-2011, ~~no~~1 stranded animal~~s~~ assigned to the Northern Florida Coastal ~~s~~Stock was entangled in 2 commercial blue crab trap/pots.~~ showed evidence of entanglement in trap-pot gear.~~ The 2 traps were wrapped tightly around the tail stock and fluke juncture.

Southeastern U.S. Shrimp Trawl Fishery

The shrimp trawl fishery operates in waters off the Florida coast. However, there has been little to no observer coverage of this fishery in the last decade. No other bottlenose dolphin mortality or serious injury related to shrimp trawling along the Florida coast has been reported to NMFS.

Hook and Line Fisheries

During 2007-2011 in the Northern Florida Coastal Stock area, 1 stranded dolphin was documented with recreational hook and line gear in its stomach.

Other Mortality

~~Seventy-eight stranded bottlenose dolphins were recovered between 2004 and 2008 in the waters of the Northern Florida Coastal stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009).~~During 2007-2011, 74 stranded bottlenose dolphins were recovered in the waters of the Northern Florida Coastal Stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). It was not possible to determine whether or not there was evidence of human interaction for ~~67~~55 of these strandings, and for ~~8~~12 it was determined there was no evidence of human interaction. The remaining 7 showed evidence of human interactions, including 3 fishery interactions, 1 boat collision, 2 mutilations and 1 entanglement wound of unknown origin. As mentioned above, 1 of the fishery interactions was an animal entangled in 2 blue crab traps, and another was an animal that had ingested recreational hook and line gear. ~~The remaining 3 showed evidence of human interaction but none showed evidence of fishery interaction, although 1 animal had rope marks on the caudal peduncle that may have been from a fishery interaction but it is not possible to determine this without examining the rope, which was not found on the animal at the time of stranding.~~ It is worth noting that during winter months, the Northern Florida

Coastal ~~s~~Stock likely overlaps with the Southern Migratory Coastal ~~s~~Stock and it is currently not possible to distinguish between them. Hence during winter months, stranded dolphins could come from either of these 2 stocks. Some (19) of the 74 strandings are also included in the stranding total for the Southern Migratory Coastal Stock.

The nearshore and estuarine habitats occupied by the coastal morphotype are adjacent to areas of high human population and some are highly industrialized. The blubber of stranded dolphins examined during the 1987-1988 mortality event contained very high concentrations of organic pollutants (Kuehl *et al.* 1991). More recent studies have examined persistent organic pollutant concentrations in bottlenose dolphin inhabiting estuaries along the Atlantic coast and have likewise found evidence of high blubber concentrations, particularly near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCK

Bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, but the Northern Florida Coastal Stock~~-~~ is a strategic stock due to the depleted listing under the Marine Mammal Protection Act~~MMPA~~. From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units and again in 2008 and 2010 to recognize resident estuarine stocks and migratory and resident coastal stocks. This stock retains the depleted designation as a result of its origins from the originally delineated depleted coastal migratory stock. PBR for the Northern Florida Coastal Stock is 7 and so the zero mortality rate goal, 10% of PBR, is 0.7. The documented annual average of human-caused mortality for this stock for 2007 – 2011 is 0.4. However, there are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. Insufficient information is available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine population trends for this stock.~~The total U.S. fishery-related mortality and serious injury for the Northern Florida Coastal stock likely is less than 10% of the calculated PBR, and thus can be considered to be insignificant and approaching zero mortality and serious injury rate. However, there are commercial fisheries overlapping with this stock that have no observer coverage. This stock retains the depleted designation as a result of its origins from the originally delineated depleted coastal migratory stock. The species is not listed as threatened or endangered under the Endangered Species Act, but this is a strategic stock due to the depleted listing under the MMPA.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Western North Atlantic Central Florida Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Geographic Range and Coastal Morphotype Habitat

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula and ~~along~~into the Gulf of Mexico~~ coast~~. Based on differences in mitochondrial DNA haplotype frequencies, ~~nearshore~~coastal animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Duffield and Wells 2002; Rosel *et al.* 2009). On the Atlantic coast, Scott *et al.* (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-1988 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks residing in coastal waters of the western North Atlantic (McLellan *et al*. 2003; Rosel *et al*. 2009).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype ~~primarily occupying~~that occupies habitats further offshore (Mead and Potter 1995; Hoelzel *et al.* 1998; Rosel *et al.* 2009). Aerial surveys conducted between 1978 and 1982 (CETAP 1982) north of Cape Hatteras, North Carolina identified two concentrations of bottlenose dolphins, one~~ inshore of~~ near the coast within the 25-m isobath and the other offshore of the 50-m isobath and concentrated at the continental shelf edge. The lowest density of bottlenose dolphins was observed over the continental shelf~~, with higher densities along the coast and near the continental shelf edge~~. It was suggested, therefore, that north of Cape Hatteras, North Carolina, the coastal morphotype is restricted to waters <25 m deep (Kenney 1990). Similar patterns were observed during summer months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al.* 2003). However, south of Cape Hatteras during both winter and summer months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al.* 2003).

To address the question of the distribution of coastal and offshore morphotypes in waters south of Cape Hatteras, tissue samples were collected in coastal, shelf and slope waters from New England to Florida between 1997 and 2006~~from large vessel surveys during the summers of 1998 and 1999, from systematic biopsy sampling efforts in nearshore waters from New Jersey to central Florida conducted in the summers of 2001 and 2002, and from winter biopsy collection effort in 2002 and 2003, in nearshore continental shelf waters of North Carolina and Georgia. Additional biopsy samples were collected in deeper continental shelf waters south of Cape Hatteras during winter 2002~~. Genetic analyses using mitochondrial DNA sequences of these biopsies identified individual animals to the coastal or offshore morphotype. Using the genetic results from all surveys combined, a logistic regression was used to model the probability that a particular bottlenose dolphin group was of the coastal morphotype as a function of environmental variables including depth, sea surface temperature and distance from shore. These models were used to partition the bottlenose dolphin groups observed during aerial surveys between the two morphotypes (Garrison *et al.* 2003).

The genetic results and spatial patterns observed in aerial surveys indicate both regional and seasonal differences in the longitudinal distribution of the two morphotypes in coastal Atlantic waters. During summer months, all biopsy samples collected from ~~nearshore~~coastal waters north of Cape Lookout, North Carolina (<20 m deep) were of the coastal morphotype, and all samples collected in deeper waters (>40 m deep) were of the offshore morphotype. South of Cape Lookout, the probability of an observed bottlenose dolphin group being of the coastal morphotype declined with increasing depth. In intermediate depth waters, there was spatial overlap between the two morphotypes. Offshore morphotype bottlenose dolphins were observed at depths as shallow as 13 m, and coastal morphotype dolphins were observed at depths of 31 m and 75 km from shore (Garrison *et al*. 2003).

Winter samples were collected primarily from ~~nearshore~~coastal waters in North Carolina and Georgia~~.~~ and ~~T~~the vast majority of ~~samples collected in nearshore waters of North Carolina during winter~~ them were of the coastal morphotype; however, one offshore morphotype group was sampled during November just south of Cape Lookout only 7.3 km from shore. Coastal morphotype samples were also collected farther away from shore at 33 m depth and 39 km ~~distance~~ from shore. The logistic regression model for this region indicated a decline in the probability of a

coastal morphotype group with increasing distance from shore; however, the model predictions were highly uncertain due to limited sample sizes and spatial overlap between the two morphotypes. Samples collected in Georgia waters also indicated significant overlap between the two morphotypes with a declining probability of the coastal morphotype with increasing depth. A coastal morphotype sample was collected 112 km from shore at a depth of 38 m. An offshore sample was collected in 22 m depth at 40 km from shore. As with the North Carolina model, the Georgia logistic regression predictions are uncertain due to limited sample size and high overlap between the two morphotypes (Garrison *et al.* 2003).

In summary, the primary habitat of the coastal morphotype of bottlenose dolphin extends from Florida to New Jersey during summer months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype occurs in lower densities over the continental shelf (waters between 20 m and 100 m depth) and overlaps spatially with the offshore morphotype.

Distinction between Coastal and Estuarine Bottlenose Dolphins

~~In addition to inhabiting coastal nearshore waters, t~~The coastal morphotype of bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Scott *et al.* 1990; Wells *et al.* 1996; Weller 1998; Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Balmer *et al.* 2008; Mazzoil *et al.* 2008). There are multiple lines of evidence supporting demographic separation between bottlenose dolphins residing within estuaries along the Atlantic coast. For example, long-term photo-identification (photo-ID) studies in waters around Charleston, South Carolina, have identified communities of resident dolphins that are seen within relatively restricted home ranges year-round (Zolman 2002; Speakman *et al.* 2006). In Biscayne Bay, Florida, there is a similar community of bottlenose dolphins with evidence of year-round residents that are genetically distinct from animals residing in a nearby estuary in Florida Bay (Litz *et al.* 2012~~07~~). A long-term photo-ID study in the Indian River Lagoon system in central Florida has also identified year-round resident dolphins repeatedly observed across multiple years (Stolen *et al.* 2007; Mazzoil *et al.* 2008).

A few published studies demonstrate that these resident animals are genetically distinct from animals in nearby coastal waters. A study conducted near Jacksonville, Florida demonstrated significant genetic differences between animals in ~~nearshore~~ coastal ~~waters~~ and estuarine waters (Caldwell 2001; Rosel *et al*. 2009) and animals resident in the Charleston estuarine system show significant genetic differentiation from animals biopsied in coastal waters of southern Georgia (Rosel *et al*. 2009). ~~In addition, stable isotope ratios of~~ ^{18}~~O relative to~~ ^{16}~~O (referred to as depleted~~ ^{18}~~O or depleted oxygen) in animals sampled along the Outer Banks of North Carolina between Cape Hatteras and Bogue Inlet during February and March were very low (Cortese 2000). One explanation for this depleted oxygen signature is that a resident group of dolphins in Pamlico Sound moves into nearby nearshore areas in the winter.~~

Despite evidence for genetic differentiation between estuarine and ~~nearshore~~coastal populations, the degree of spatial overlap between these populations remains unclear. Photo-ID studies within estuaries demonstrate seasonal immigration and emigration and the presence of transient animals (e.g., Speakman *et al*. 2006). In addition, the degree of movement of resident estuarine animals into coastal waters on seasonal or shorter time scales is poorly understood. However, for the purposes of ~~this analysis~~stock definition, bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct from those inhabiting coastal habitats. Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.

Definition of the Central Florida Coastal Stock

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in strandings during a large scale mortality event occurring during 1987-1988 (Scott *et al.* 1988). However, re-analysis of stranding data (McLellan *et al.* 2003) and extensive analysis of genetic (Rosel *et al.* 2009), photo-ID (Zolman 2002) and satellite telemetry (Hohn and Hansen, NMFS unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are five coastal stocks of bottlenose dolphins: the Northern Migratory and Southern Migratory ~~s~~Stocks, a South Carolina/Georgia Coastal ~~s~~Stock, a Northern Florida Coastal ~~s~~Stock and a Central Florida Coastal ~~s~~Stock.

The spatial extent of these stocks, their potential seasonal movements, and their relationships with estuarine stocks are poorly understood. Migratory movement and spatial distribution of the Northern Migratory ~~s~~Stock is best understood based on tag-telemetry, photo-ID and aerial survey data and migrates seasonally between coastal waters

of central North Carolina and New Jersey. It is not thought to overlap with the South Carolina/Georgia Coastal ~~s~~Stock in any season. The Southern Migratory ~~s~~Stock is defined primarily on satellite tag telemetry studies and is thought to migrate south from waters of southern Virginia and north central North Carolina in the summer to waters south of Cape Fear and as far south as coastal Florida during winter months. ~~–~~It is unclear whether this stock overlaps with the Central Florida Coastal ~~s~~Stock in any season.

During summer months when the Southern Migratory ~~s~~Stock is found in waters north of Cape Fear, North Carolina, bottlenose dolphins are still seen in coastal waters of South Carolina, Georgia and Florida, indicating the presence of additional stocks of coastal animals. Speakman *et al.* (2006) using photo-ID studies documented dolphins in coastal waters off Charleston, South Carolina, that are not known resident members of the estuarine stock. Genetic analyses of samples from northern Florida, Georgia and central South Carolina (primarily the estuaries around Charleston), using both mitochondrial DNA and nuclear microsatellite markers indicate significant genetic differences between these areas (NMFS 2001; Rosel *et al*. 2009). This stock assessment report addresses the Central Florida

~~-~~Coastal stock, which is present in coastal Atlantic waters from 29.4°N south to the western end of Vaca Key (~24.69°N –81.11°W) where the stock boundary for the Florida Keys ~~s~~Stock begins (Figure 1). There has been little study of bottlenose dolphin stock structure in coastal waters of southern Florida, therefore the southern boundary of the Central Florida ~~s~~Stock is uncertain. There is no obvious boundary defining the offshore extent of this stock. The combined genetic and logistic regression analysis (Garrison *et al.* 2003) indicated that in waters less than 10 m depth, 70% of the bottlenose dolphins were of the coastal morphotype. Between 10 and 20 m depth, the percentage of animals of the coastal morphotype dropped precipitously, and at depths >40 m nearly all (>90%) animals were of the offshore morphotype. These spatial patterns may not apply in the Central Florida Coastal ~~s~~Stock, as there is a significant change in the bathymetric slope and a close approach of the Gulf Stream to the shoreline south of Cape Canaveral.

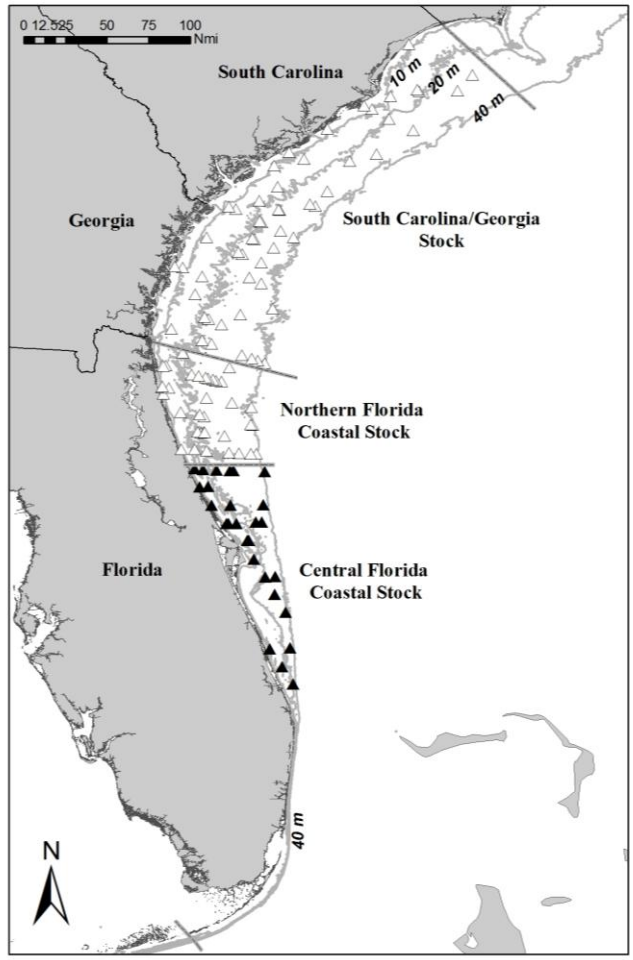

Figure 1. *The Central Florida Coastal stock of bottlenose dolphins (29.4°N to Vaca Key). Symbols represent all sightings of bottlenose dolphin groups from NMFS 2010 & 2011 aerial surveys; dark symbols- groups within the boundaries of this stock. In waters >20 m, sightings may include the offshore morphotype of bottlenose dolphins.*

POPULATION SIZE

The best available estimate for the Central Florida Coastal Stock of bottlenose dolphins in the western North Atlantic is 4,895 (CV=0.71; Table 1). This estimate is from aerial surveys conducted during the summers of 2010 and 2011 covering waters from Florida to New Jersey.

Earlier abundance estimates

~~–~~Earlier abundance estimates for the Ce~~b~~ntral Florida Coastal ~~s~~Stock were derived from aerial surveys conducted during the summer of 2002 and 2004. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. ~~-~~These surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias. ~~-~~In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the

majority of effort in the shallow depth stratum. -Observed bottlenose dolphin groups from these were partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003). -The previous best abundance estimate was based upon an average of the estimates from the 2002 and 2004 aerial surveys. -This estimate was 6,318 (CV=0.26).

Recent surveys and abundance estimates

Summer 2002 and 200429.4N Latitude to Ft. Pierce, FL6,3180.26Summer 2010 and 2011~~29.4N Latitude to Ft. Pierce, FL4,8950.71~~Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. Survey effort was also stratified to optimize coverage in seasonal management units. The surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias.

The winter survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay. A total of 6,411 km of trackline was completed during the survey, and 185 bottlenose dolphin groups were sighted including 2,114 individual animals. No bottlenose dolphins were sighted north of Chesapeake Bay where water temperatures were <9.5ºC. During the summer survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia/Florida state line. A total of 185 bottlenose dolphin groups were sighted during summer including 2,544 individual animals.

In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were a total of 140 sightings of bottlenose dolphins including 3,093 individual animals. A winter survey was conducted between 30 January and 9 March 2005 covering waters from the mouth of Chesapeake Bay through central Florida. The survey covered 5,457 km of trackline and observed 135 bottlenose dolphin groups accounting for 957 individual animals.

Abundance estimates for bottlenose dolphins in each stock were calculated using line transect methods and distance analysis (Buckland *et al.* 2001). The 2002 surveys included two teams of observers to derive a correction for visibility bias. The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct-duplicate estimator (Palka 1995). The resulting estimate of the probability of seeing animals on the trackline was applied to abundance estimates for the summer 2004 and winter 2005 surveys. Observed bottlenose dolphin groups were also partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al.* 2003).

For the Central Florida Coastal s~~S~~tock, the mean of the summer 2002 and 2004 abundance estimates provided the best estimate of abundance. There is strong inter-annual variation in the abundance estimates and observed spatial distribution of bottlenose dolphins in this region that may indicate movements of animals in response to environmental variability. The abundance estimate for this stock from the summer 2002 survey was 718 (CV=0.51) and that from summer 2004 was 11,918 (CV=0.27). The best abundance estimate is the unweighted average of these two surveys and is 6,318 (CV=0.26). It is unknown why the abundance estimates from 2002 and 2004 differ by nearly an order of magnitude. Survey methodologies did not differ significantly between the years, although a larger amount of survey effort was expended in the Northern Florida and Central Florida strata during 2004 than in 2002. The disparity most likely represents variability in dolphin spatial distribution between those two years. Because the two abundance estimates differ so dramatically, using an inverse-variance weighted mean when combining the estimates would heavily weight the smaller of the two estimates, and therefore would likely introduce negative bias into the estimate of stock size. Therefore, an unweighted mean of the 2002 and 2004 abundance estimates was calculated and used as the best estimate of stock abundance.

The Southeast Fisheries Science Center conducted aerial surveys of continental shelf waters along the U.S. East Coast from southeastern Florida to Cape May, New Jersey, during the summers of 2010 and 2011. The surveys were conducted along tracklines oriented perpendicular to the shoreline that were latitudinally spaced 20 km apart and covered waters from the shoreline to the continental shelf break. The summer 2010 survey was conducted during 24 July–14 August 2010, and 7,944 km of on-effort tracklines completed. A total of 127 bottlenose dolphin groups

were observed including 1,541 animals. During the 2011 summer survey, 8,665 km of trackline were completed between Cape May, New Jersey and Ft. Pierce, Florida. The survey was conducted during during 6 July - 29 July 2011. The 2011 survey also included more closely spaced "fine-scale" tracklines in waters offshore of New Jersey and Virginia within areas being evaluated for the placement of offshore energy installations. A total of 112 bottlenose dolphin groups were sighted including 1,339 animals.

Both the summer 2010 and 2011 surveys were conducted using a two-team approach to develop estimates of visibility bias using the independent observer approach with Distance analysis (Laake *et al.* 2004). However, the detection functions from both surveys indicated a decreased probability of detection near the trackline, which limited the effectiveness of the method for correcting for visibility bias due to a relatively small number of sightings made by both teams near the trackline. Abundance estimates were therefore derived by combining the sightings from both teams during a survey and "left-truncating" the data by analyzing only sightings occurring greater than 100 m from the trackline during the 2010 survey and 50 m during the 2011 survey (Buckland *et al.* 2001). Detection functions were fit to these left-truncated data accounting for the effects of survey conditions (e.g., sea state, glare, water color) on the detection probabilities. A logistic regression model was used to estimate the probability that a given group of dolphins observed during the aerial survey was of the coastal vs. offshore morphotype as a function of water depth (Garrison *et al.* 2003). This probability was incorporated into the abundance estimation to derive an estimate of coastal morphotype dolphins observed during the 2010 and 2011 aerial surveys. A bootstrap resampling approach was used to estimate the variance of the estimates. The resulting abundance estimates assume that detection probability at the truncation distance is equal to 1. -While the estimates could not be explicitly corrected for this assumption, analyses of the summer 2010 data suggest that this bias is likely small.

The abundance estimates for the Central Florida Coastal Stock were based upon tracklines and sightings occurring between 29.4°N latitude and Ft. Pierce, Florida and in waters from the shoreline to the 40-m isobath. The abundance estimate derived from the summer 2010 survey was 9,842 (CV=0.84), and the estimate from the summer 2011 survey was 1,338 (CV=0.65). The best estimate is a weighted average of these two with higher weighting given to the more precise estimate from 2011. The resulting best estimate is 4,895 (CV=0.71).

Table 1. Summary of abundance estimates for the western North Atlantic Central Florida Coastal Stock of bottlenose dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Summer 2002 and 2004	29.4°N Latitude to Ft. Pierce, FL	6,318	0.26
Summer 2010 and 2011	29.4°N Latitude to Ft. Pierce, FL	4,895	0.71

Minimum Population Estimate

The minimum population size (Nmin) for each stock was calculated as the lower bound of the 60% confidence interval for a log-normally distributed mean (Wade and Angliss 1997). The best estimate for the Central Florida Coastal ~~s~~Stock is ~~6,318~~ 4,895 (CV=0.71~~26~~). The resulting minimum population estimate is ~~5,094~~2,851.

Current Population Trend

There are limited data available to assess population trends for this stock. -The estimates from the 2002/2004 and 2010/2011 surveys are not significantly different from each other; however, it should be noted that the relatively large CVs limit the power to detect significant differences. -The statistical power to detect a trend in abundance for this species is poor due to the relatively imprecise estimates and long survey interval. –For example, the power to detect a precipitous decline (i.e., 50% decrease in 15 years) in abundance with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007).
~~There are insufficient data to determine the population trends for this stock.~~

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the western North Atlantic coastal morphotype. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; (Wade and Angliss 1997). The minimum population size of the Central Florida Coastal ~~s~~Stock of bottlenose dolphins is ~~5,094~~ 2,851. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is depleted. PBR for this stock of bottlenose dolphins is ~~51~~29.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the Central Florida Coastal Stock during 2007-2011 is unknown. There were 4 dolphins entangled in crab trap gear, resulting in 1 mortality and at least 2 serious injuries. One other dolphin may have been seriously injured as well, but its condition could not be determined. One dead dolphin was entangled in hook and line gear. These represent minimum known counts of fishery-caused mortality and serious injury.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

~~Three~~Five Category II fisheries have the potential to interact with the Central Florida Coastal ~~s~~Stock of bottlenose dolphins – the Southeastern U.S. Atlantic shark gillnet fishery, the Southeast Atlantic gillnet fishery, ~~and~~ the Atlantic blue crab/trap pot fishery, Southeastern U.S. Atlantic shrimp trawl fishery and Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot fishery. In addition, the following Category III fisheries may interact with this stock: ~~Southeastern U.S. Atlantic shrimp trawl fishery;~~ Florida spiny lobster trap/pot~~; and Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot~~ and Atlantic Ocean commercial passenger fishing vessel (hook and line). Only limited observer data are available for these and other fisheries that may interact with this stock. Therefore, the total average annual mortality estimate is a lower bound of the actual annual human-caused mortality for each stock. Detailed fishery information is presented in Appendix III.

Southeastern U.S. Atlantic Shark Gillnet Fishery and Southeast Atlantic Gillnet Fishery

Gillnet fisheries targeting finfish and sharks operate in southeast waters between North Carolina and southern Florida. Historically, a drift net fishery targeting coastal sharks operated in waters including within the Central Florida Coastal ~~s~~Stock boundaries during winter months. Bottlenose dolphin takes (n=2) were observed in the drift net fisheries targeting sharks in 2002 and 2003 (Garrison 2007). Currently, gillnet fisheries include a number of different fishing methods and gear types including drift nets, "strike" fishing, and anchored ("sink") gillnets. The majority of this fishing is reported from waters of North Carolina and central Florida. However, there has been a significant reduction in the amount of drift gillnet fishing targeting sharks during the last several years. ~~Gillnet trips (average 766 annually from 2004-2008) are reported within the bounds of the Central Florida Coastal stock.~~ There have been no observed bottlenose dolphin takes within the stock boundaries since 2003~~ (Table 1)~~.

~~Table 1. Summary of the 2004-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus truncatus*) by stock in the southeast gillnet fisheries in water of the Central Florida Coastal stock. Data include years sampled (Years), number of vessels reporting effort within the fishery (Vessels), type of data used (Data Type), annual observer coverage (Observer Coverage), mortalities recorded by on-board observers (Observed Mortality), estimated annual mortality (Estimated Mortality), estimated CV of the annual mortality (Estimated CVs), and mean annual mortality (CV in parentheses).~~

~~Stock~~	~~Years~~	~~Vessels~~	~~Data Type [a]~~	~~Observer Coverage [b]~~	~~Observed Serious Injury~~	~~Observed Mortality~~	~~Estimated Mortality~~	~~Estimated CVs~~	~~Mean Annual Mortality~~
~~Central Florida Coastal~~	~~2004-2008~~		~~Obs. Data, SEFSC FVL~~	~~0.07, 0.09, 0.07, 0.02, 0.05~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~NA~~	~~0~~

~~NA = cannot be calculated~~

~~[a] Observer data are used to estimate bycatch rates. The SEFSC Fishing Vessel Logbook (FVL) is used to estimate effort as total number of reported trips with effort inside the stock boundaries. Reported fishery effort includes a number of different fishing methods and target species that cannot be separated.~~

~~[b] Percent observer coverage is reported on a per trip basis as limited by reporting to the FVL. Multiple sets may occur on any given trip.~~

~~**Atlantic Blue Crab/Trap Pot Fishery**~~

~~During 2004-2008, no stranded animals assigned to the Central Florida Coastal stock were confirmed to have been entangled in commercial trap pot gear.~~

Trap/Pot Fisheries

During 2007-2011, 4 stranded animals assigned to the Central Florida Coastal Stock were reported entangled in trap/pot gear or probable trap/pot gear, resulting in 1 mortality and 3 animals that were disentangled and released alive. Of the 3 animals released alive, 2 were considered seriously injured and the remaining animal's condition could not be determined (Maze-Foley and Garrison in prep). It was not possible to determine which specific trap/pot fishery (blue crab, stone crab or spiny lobster) interacted with these strandings.

Southeastern U.S. Shrimp Trawl Fishery

The shrimp trawl fishery operates in waters off the Florida coast. However, there has been little to no observer coverage of this fishery in the last decade. No ~~other~~ bottlenose dolphin mortality or serious injury related to shrimp trawling along the Atlantic coast of Florida ~~coast~~ has been reported to NMFS.

Hook and Line Fisheries

During 2007-2011 in the Central Florida Coastal Stock area, 1 stranded dolphin was documented entangled in high test monofilament line.

Other Mortality

~~Eighty-two stranded bottlenose dolphins were recovered between 2004 and 2008 in the waters of the Central Florida Coastal stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009).~~During 2007-2011, 109 stranded bottlenose dolphins were recovered in the waters of the Central Florida Coastal Stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). It was not possible to determine whether or not there was evidence of human interaction for ~~60~~82 of these strandings, and for ~~16~~21 it was determined there was no evidence of human interaction. The remaining 6 showed evidence of human interactions, all of which were fisheries interactions with 1 animal mutilated as well. As mentioned above, ~~Three~~4 animals were reported entangled in gear consistent with a trap/-pot fishery, but no gear was ~~only~~ recovered ~~for 1 animal, possibly lobster pot gear~~. One animal was entangled in high test monofilament as mentioned above, and the final animal had

line markings, deep lacerations and puncture wounds (fisheries interaction plus mutilation). ~~The 5th animal had scars consistent with net entanglement and the last an old bullet in the skull. Neither of the last 2 findings was thought to be the cause of the mortality.~~

The Indian River Lagoon Estuarine System (IRLES) Stock experienced an Unusual Mortality Event (UME) in 2008. From May to August a total of 47 bottlenose dolphins from the IRLES Stock and 1 dolphin from the Central Florida Coastal Stock were considered to be part of this UME (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). Infectious disease is suspected as a possible cause of this event.

The nearshore and estuarine habitats occupied by the coastal morphotype are adjacent to areas of high human population and some are highly industrialized. The blubber of stranded dolphins examined during the 1987-1988 mortality event contained very high concentrations of organic pollutants (Kuehl *et al.* 1991). More recent studies have examined persistent organic pollutant concentrations in bottlenose dolphin inhabiting estuaries along the Atlantic coast and have likewise found evidence of high blubber concentrations particularly near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCK

Bottlenose dolphins are not listed as threatened or endangered under the Endangered Species Act, but the Central Florida Coastal Stock is a strategic stock due to the depleted listing under the Marine Mammal Protection Act~~MMPA.~~ From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units and again in 2008 and 2010 to recognize resident estuarine stocks and migratory and resident coastal stocks. This stock retains the depleted designation as a result of its origins from the originally delineated depleted coastal migratory stock. PBR for the Central Florida Coastal Stock is 29 and so the zero mortality rate goal, 10% of PBR, is 2.9. The documented annual average of human-caused mortality for this stock for 2007 – 2011 ranges from 0.6 to 1.0. However, there are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. Insufficient information is available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine population trends for this stock.~~The total U.S. fishery-related mortality and serious injury for the Central Florida Coastal stock likely is less than 10% of the calculated PBR, and thus can be considered to be insignificant and approaching zero mortality and serious injury rate. However, there are commercial fisheries overlapping with this stock that have no observer coverage. This stock retains the depleted designation as a result of its origins from the originally delineated depleted coastal migratory stock. The species is not listed as threatened or endangered under the Endangered Species Act, but this is a strategic stock due to the depleted listing under the MMPA.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Northern North Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present primarily in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data).~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005; Balmer *et al.* 2008).

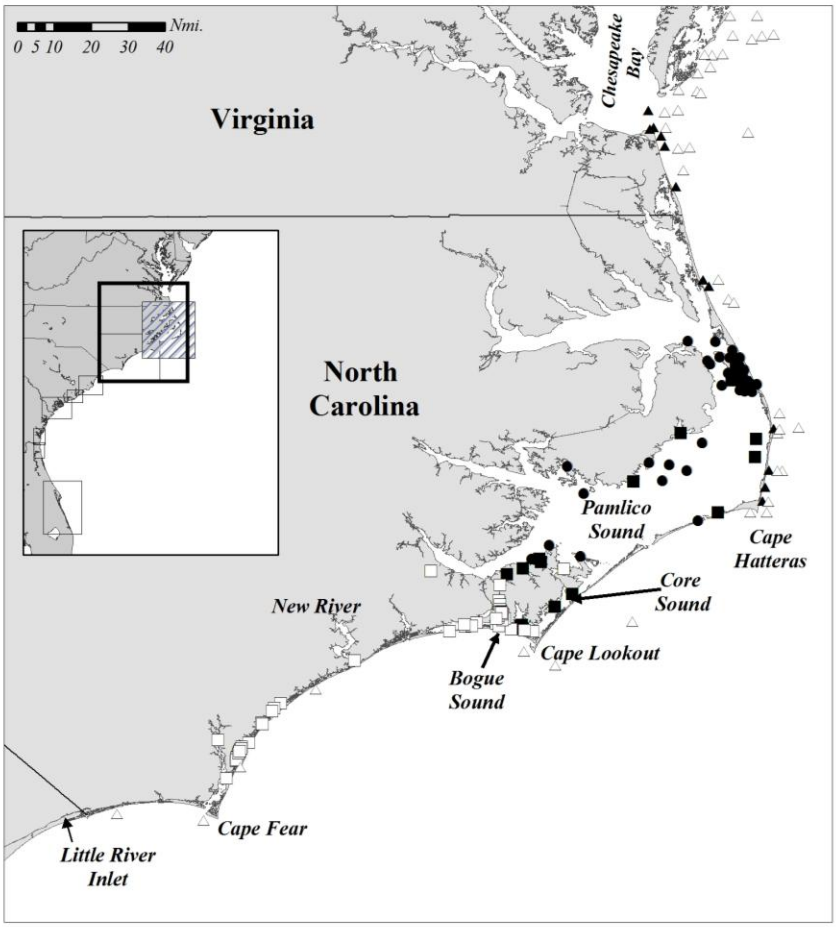

Figure 1. *The ~~summer (July-August)~~ distribution of bottlenose dolphins occupying coastal and estuarine waters in North Carolina and Virginia during July-August. Locations are shown from aerial surveys (triangles), satellite-linked telemetry (circles), and photo-identification studies (squares). Sightings assigned to the Northern North Carolina Estuarine System stock are shown with filled symbols (all fall within hatched box in inset map). Photo-identification data are courtesy of Duke University and the University of North Carolina at Wilmington.*

The Northern North Carolina Estuarine System (NNCES) Stock is best defined as animals that occupy primarily estuarine waters of Pamlico Sound during ~~summer~~warm water months (July-August). Members of this stock are also thought to make use of coastal waters (<1 km from shore) of North Carolina from Beaufort north to southern Virginia and the lower Chesapeake Bay during this time period. During colder water months, these animals move out of Pamlico Sound and occupy coastal waters (< ~~1~~3km from

shore) between the New River and Cape Hatteras.

The movements and range of this stock have been inferred from a combination of photo-ID, tag telemetry, stable isotope and genetic data. Animals captured and released near Beaufort, North Carolina, were fitted with satellite-linked transmitters and or freeze-branded during July 1995 (30 animals) (Hansen and Wells 1996), November 1999 (3 animals), April 2000 (8 animals) and April 2006 (5 animals) (Hohn and Hansen, NMFS unpublished data). Long-term photo-ID studies that have been conducted in waters of North Carolina include records of some of these animals and revealed that 18 occupied waters of Pamlico Sound during warm water months. One animal that was tagged near Virginia Beach in September 1998 was observed to move south into waters of Pamlico Sound and had a photo-ID record within the sound during July (NMFS unpublished data) providing evidence that at least some members of this stock may move into nearshore coastal waters along the northern coast of North Carolina and into coastal waters of Virginia and perhaps into Chesapeake Bay. In addition, there are photo-ID matches between inshore waters of Virginia Beach, Virginia, and Pamlico Sound (Urian, pers. comm.) that also demonstrate movements of NNCES animals between these areas during warm water months. There are fewer telemetry data for assigned NNCES animals during cold water months. However, photo-ID studies, available tag data and stable isotope data indicate that the stock moves out of the waters of Pamlico Sound into coastal waters south of Cape Hatteras during cold water months. Telemetry records show that NNCES animals move as far south as the New River during January and February (NMFS unpublished data). In addition, stable isotope analysis of animals sampled along the beaches of North Carolina between Cape Hatteras and Bogue Inlet during February and March showed very low stable isotope ratios of ^{18}O relative to ^{16}O (referred to as "depleted oxygen", Cortese 2000). One explanation for the depleted oxygen signature is a resident group of dolphins in Pamlico Sound that move into nearby coastal waters in the winter (NMFS 2001).

The movements of animals from the NNCES Stock are distinct from those of the Southern North Carolina Estuarine System Stock (SNCES). Some of the animals tagged or freeze-branded near Beaufort moved south to Cape Fear and occupied nearshore coastal and estuarine waters during winter months. During warm water months, these animals moved north and occupied inshore and nearshore coastal waters near Cape Lookout including Bogue Sound and Core Sound. It is probable that there is spatial overlap between these 2 estuarine stocks during this time in the waters near Beaufort. However, SNCES Stock animals were not observed to move north of Cape Lookout in coastal waters nor into the main portion of Pamlico Sound during summer (NMFS unpublished data; Duke University unpublished data; University of North Carolina at Wilmington unpublished data). These movement patterns are consistent with those seen in resightings of individual dolphins during a photo-ID study that sampled much of the estuarine waters of North Carolina (Read *et al.* 2003). Read *et al.* (2003) suggested that movement patterns, differences in group sizes, and habitats are consistent with 2 stocks of animals occupying estuarine waters of North Carolina. Finally, genetic analysis of samples from animals in waters of southern North Carolina (between Cape Lookout and the North Carolina/South Carolina border) demonstrate significant differentiation from animals occupying waters from Virginia and further north and waters of South Carolina (Rosel *et al.* 2009).

In summary, during warm water months, the NNCES Stock occupies primarily estuarine waters of central and northern North Carolina, particularly Pamlico Sound, as well as nearshore coastal waters (< 1 km from shore) up to Assateague, Virginia, including the lower Chesapeake Bay (Figure 1). It likely overlaps with animals from the Southern Migratory Stock in coastal waters during these months, and SNCES Stock animals at the northern end of their range. During cold water months, the NNCES Stock primarily moves out of estuarine waters and occupies nearshore coastal waters (< 3km from shore) between the New River and Oregon Inlet. It overlaps with the Northern Migratory Stock during this period, particularly between Cape Lookout and Cape Hatteras and may overlap with the Southern Migratory Stock in the smaller region between the New River and Beaufort Inlet. The timing of the seasonal movements into and out of Pamlico Sound and north along the coast likely occurs with some inter-annual variability related to seasonal changes in water temperatures and/or prey availability.

In prior stock assessment reports, the animals within the estuarine waters of Pamlico Sound were included in the abundance estimates and stock assessment reports for the Northern Migratory Stock and the winter “mixed” North Carolina management unit of coastal bottlenose dolphins (Waring *et al.* 2007). However, they are now recognized as a distinct stock based upon these differences in seasonal ranging patterns and stable isotope signatures.

~~The ranging patterns of bottlenose dolphins in photo-ID studies support the presence of a group of dolphins within these waters that are distinct from both dolphins occupying estuarine and coastal waters in southern North Carolina and animals in the Northern and Southern Migratory Stocks that occupy coastal waters of North Carolina at certain times of the year (Read *et al.* 2003; NMFS 2001; NMFS unpublished data). In addition, stable isotope analysis of animals sampled along the beaches of North Carolina between Cape Hatteras and Bogue Inlet during February and~~

~~March showed very low stable isotope ratios of ^{18}O relative to ^{16}O (referred to as "depleted oxygen", Cortese 2000). One explanation for the depleted oxygen signature is a resident group of dolphins in Pamlico Sound that move into nearby coastal waters in the winter (NMFS 2001). The estuarine waters of Pamlico Sound had previously been included in the abundance estimates and stock assessment reports for the Northern migratory stock and the winter "mixed" North Carolina management unit of coastal bottlenose dolphins (Waring *et al.* 2007). However, they are now recognized as a distinct stock based upon these differences in seasonal ranging patterns and stable isotope signatures.~~

~~The seasonal movements of the NNCES Stock are best described using a combination of telemetry and long-term photo-ID studies. Animals captured and released near Beaufort, North Carolina, were fitted with satellite-linked transmitters during November 1999 (3 animals), April 2000 (8 animals), and April 2006 (5 animals) (NMFS unpublished data). In addition, long term photo-ID studies have been conducted in waters of North Carolina that include records of both these tagged animals and animals that were captured and freeze branded near Beaufort, North Carolina, during summer months (Hansen and Wells 1996; Duke University unpublished data; University of North Carolina at Wilmington unpublished data; NMFS unpublished data). Of these tagged or freeze branded animals, 18 occupied waters of northern Pamlico Sound during summer months and hence were identified as belonging to the NNCES Stock. The NNCES Stock occurs primarily within the waters of Pamlico Sound north of Core Sound during summer months (July-August). There is evidence that some of these animals also move into nearshore coastal waters along the northern coast of North Carolina and into coastal waters of Virginia and perhaps into Chesapeake Bay. One animal that was tagged near Virginia Beach in September 1998 was observed to move south into waters of Pamlico Sound and had a photo-ID record within the sound during July (NMFS unpublished data). In addition, there are photo-ID matches between inshore waters of Virginia Beach, Virginia, and Pamlico Sound (Urian, pers. comm.) that also demonstrate movements of NNCES animals between these areas. Therefore, it is presumed that the spatial range of NNCES animals during summer and fall months (July-October) includes Pamlico Sound and coastal waters (<1 km from shore) of North Carolina from Beaufort north to southern Virginia and the lower Chesapeake Bay (Figure 1).~~

~~There are fewer telemetry data for assigned NNCES animals during winter months. However, photo-ID studies, available tag data and stable isotope data indicate that the stock moves out of the waters of Pamlico Sound into coastal waters south of Cape Hatteras during late fall and through winter (November – April). Telemetry records show that NNCES animals move as far south as the New River during winter months (January-February) (NMFS unpublished data). The Northern Migratory Stock also occupies the nearshore coastal waters of North Carolina during these months, and hence there is likely overlap between these stocks, particularly between Cape Hatteras and Cape Lookout.~~

~~The movements of animals from the NNCES Stock are distinct from those of the Southern North Carolina Estuarine System Stock (SNCES). Some of the animals tagged or freeze branded near Beaufort moved south to Cape Fear and occupied nearshore coastal and estuarine waters during winter months. During summer and fall, these animals moved north and occupied inshore and nearshore coastal waters near Cape Lookout including Bogue Sound and Core Sound. It is probable that there is spatial overlap between these 2 estuarine stocks during late summer and fall in the waters near Beaufort. However, SNCES Stock animals were not observed to move north of Cape Lookout in coastal waters nor into the main portion of Pamlico Sound during summer (NMFS unpublished data; Duke University unpublished data; University of North Carolina at Wilmington unpublished data). These movement patterns are consistent with those in resightings of individual dolphins during a photo-ID study that sampled much of the estuarine waters of North Carolina (Read *et al.* 2003). Read *et al.* (2003) suggested that movement patterns, differences in group sizes, and habitats are consistent with 2 stocks of animals occupying estuarine waters of North Carolina. Finally, genetic analysis of samples from animals in waters of southern North Carolina (between Cape Lookout and the North Carolina/South Carolina border) demonstrate significant differentiation from animals occupying waters from Virginia and further north and waters of South Carolina (Rosel *et al.* 2009).~~

~~In summary, during summer and fall months (July-October), the NNCES Stock occupies waters of Pamlico Sound and nearshore coastal (<1 km from shore) and estuarine waters of central and northern North Carolina to Virginia Beach and the lower Chesapeake Bay (Figure 1). It likely overlaps with animals from the Southern Migratory Stock in coastal waters during these months. During late fall and winter (November-March), the NNCES Stock moves out of estuarine waters and occupies nearshore coastal waters between the New River and Cape Hatteras. It overlaps with the Northern Migratory Stock during this period, particularly between Cape Lookout and Cape Hatteras. It appears that the region near Cape Lookout including Bogue Sound and Core Sound is an area of overlap with the SNCES Stock during late summer.~~

POPULATION SIZE

The best available abundance estimate for the NNCES Stock is 950 animals (CV=0.23, 95% Confidence Interval=516-1,384) based upon photo-ID mark-recapture surveys in 2006 (Urian *et al*., unpublished manuscript). The survey did not include estuarine waters of Albemarle or Currituck Sounds nor more northern estuarine and coastal waters, and it is therefore possible that some portion of the NNCES Stock was outside of the boundaries of the current survey. Thus, the abundance estimate is most likely negatively biased.

Earlier abundance estimates

Read *et al.* (2003) provided the first abundance estimate of bottlenose dolphins that occur within the estuarine portion of the NNCES Stock range. This estimate was based on a photo-ID mark-recapture survey of a portion of North Carolina waters inshore of the barrier islands, conducted during July 2000. Because the survey did not sample all of the estuarine waters where dolphins are known to occur, the estimates of abundance may be negatively biased. Read *et al.* (2003) estimated the number of animals in the inshore waters of North Carolina equivalent to that of the NNCES Stock to be 919 (95% CI 730 - 1,190, CV=0.13). Gubbins *et al.* (2003) also conducted a photo-ID mark-recapture study during 1997 and provided an abundance estimate (513, CV=0.13) for inshore and nearshore waters near Beaufort, North Carolina, but this area represented only a small portion of the NNCES Stock area and included animals in coastal waters. Goodman *et al.* (2007) conducted seasonal, strip-transect aerial surveys of southwestern Pamlico Sound from July 2004 through April 2006. Their survey area sampled approximately 25% or less of the waters within the NNCES Stock boundaries. Mean seasonal abundance estimates ranged from a low of 54 (CV=0.46) during June - August 2005 (summer), to a high of 426 (CV=0.35) during September - November 2004 (autumn), but seasonal patterns were not consistent among years. For example, the estimate for spring of 2005 was only 71 (CV=0.39) while the estimate for spring of 2006 was 323 (CV=0.35).

Since both telemetry studies and photo-identification records indicate that some portion of the NNCES Stock occurs in coastal waters between Cape Hatteras, North Carolina, and Virginia during summer months, it is appropriate to include animals from summer aerial surveys of these areas in the abundance estimate. Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during ~~winter (~~January-February~~)~~ and ~~summer (~~July-August~~)~~ of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. The surveys employed 2 observer teams operating independently on the same aircraft to derive a correction for~~estimate~~ visibility bias. Abundance estimates were calculated using line transect methods and distance analysis (Buckland *et al.* 2001). ~~The 2002 surveys included 2 teams of observers to derive a correction for visibility bias.~~ The independent and joint estimates from the 2 survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct duplicate estimator (Palka 1995).

An abundance estimate for the NNCES Stock in coastal waters was derived from the summer 2002 aerial survey. Survey data were post-stratified to estimate the abundance of dolphins within a strip extending from the shoreline to 1km from shore between Cape Lookout, North Carolina, and Virginia Beach, Virginia. Telemetry records indicated that NNCES animals rarely ventured further away from shore. However, animals from the Southern Migratory Stock do occur within this strip during summer months. Therefore, the estimate of abundance within this strip includes both NNCES animals and Southern Migratory animals and hence overestimates abundance of the NNCES Stock in coastal waters.~~-~~ The resulting ~~best~~ abundance estimate for the NNCES Stock in coastal waters was 468 (CV=0.32).

The abundance estimate for the NNCES Stock during 2000-2002 was the combined abundance from estuarine and coastal waters. This combined estimate is 1,387 (CV=0.17).

Recent surveys and abundance estimates

A photo-ID mark-recapture study was conducted by Urian *et al.* (unpublished manuscript) in 2006, using similar methods to those in Read *et al.* (2003) and included estuarine waters of North Carolina from and including the Little River Inlet Estuary (near the North Carolina/South Carolina border) to and including Pamlico Sound. The survey also included coastal waters extending up to 1 km from shore, which is also consistent with the current understanding of the distribution of this stock. The survey did not include estuarine waters of Albemarle or Currituck Sounds nor more northern estuarine and coastal waters, and it is therefore likely that some portion of the

NNCES Stock was outside of the boundaries of the current survey. Thus, the updated abundance estimate is most likely negatively biased. A boundary line between the NNCES Stock and the neighboring SNCES Stock was identified at 34°46' N Latitude in central Core Sound, and this boundary is consistent with the descriptions of the ranges of the 2 stocks during summer months. The resulting abundance estimate included a correction for the proportion of dolphins with non-distinct fins in the population. The abundance estimate for the NNCES Stock based upon photo-ID mark-recapture surveys in 2006 was 950 animals (CV=0.23, 95% Confidence Interval=516-1,384; Urian *et al*., unpublished manuscript). This is the best available abundance estimate for the NNCES Stock.~~A photo-ID mark-recapture study was conducted in 2006 using similar methods to those in Read *et al.* (2003) which included estuarine waters from Core Sound to Albemarle Sound. A boundary line between the NNCES Stock and the neighboring SNCES Stock was identified at 34°46' N Latitude in central Core Sound, and this boundary is consistent with the descriptions of the ranges of the 2 stocks during summer months. The survey also included coastal waters extending up to 1km from shore, which is also consistent with the current understanding of the distribution of this stock. The survey did not include estuarine and coastal waters north of Albemarle Sound, and it is therefore possible that some portion of the NNCES Stock was outside of the boundaries of the current survey. Thus, the updated abundance estimate is most likely negatively biased. The resulting abundance estimate includes a correction for the proportion of dolphins with non-distinct fins in the population. The abundance estimate for the NNCES Stock based upon photo-ID mark-recapture surveys in 2006 was 950 animals (CV = 0.23, 95% Confidence Interval = 516-1,384; Urian *et al*., unpublished manuscript). This is the best available abundance estimate for the NNCES Stock.~~

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the NNCES Stock is 950 (CV=0.23). The minimum population estimate for the NNCES Stock is 785.

Current Population Trend

There are insufficient data to determine the population trends for this stock. However, Urian *et al.* (unpublished manuscript) noted that there was no statistically significant difference between abundance estimates within estuarine waters from the surveys conducted during 2000 and those conducted during 2006.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the NNCES Stock of bottlenose dolphins is 785. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. The resulting PBR for this stock is 7.9 animals.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total estimated average annual fishery mortality of the NNCES Stock ranges between 1.9 and 9.1 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines

serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

~~The NNCES Stock interacts with 3 Category II fisheries: the Atlantic blue crab trap/pot fishery, North Carolina long haul seine fishery and North Carolina inshore gillnet fishery. There is no systematic federal observer coverage of these fisheries by the National Marine Fisheries Service (NMFS), although the North Carolina Division of Marine Fisheries operates systematic coverage of the fall flounder gillnet fishery in Pamlico Sound (Price 2008). As a result, information about interactions with North Carolina inshore fisheries is based solely on stranding data and it is not possible to estimate the annual number of interactions or mortalities in these fisheries. The NNCES Stock may also interact with the mid-Atlantic gillnet fishery, the mid-Atlantic haul/beach seine fishery and the Virginia Pound Net fishery. The magnitude of the interaction with each of these fisheries is unknown because of both uncertainty in the movement patterns of the stock and the spatial overlap between the NNCES Stock and other bottlenose dolphin stocks in coastal waters. The total estimated average annual fishery mortality on the NNCES Stock ranges between a minimum of 4.1 and a maximum of 22.6 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.~~ The NNCES Stock has the potential to interact with 1 Category I and 5 Category II fisheries: mid-Atlantic gillnet fishery (Category I); the Atlantic blue crab trap/pot fishery, North Carolina long haul seine fishery, North Carolina inshore gillnet fishery, mid-Atlantic haul/beach seine fishery, and Virginia pound net fishery. The NNCES stock could also interact with 2 Category III fisheries: the U.S. mid-Atlantic mixed species stop seine/weir/pound net, which includes the North Carolina pound net fishery, and the Atlantic Ocean commercial passenger fishing vessel (hook and line) fishery.

The magnitude of the interactions with each of these fisheries is unknown because of both uncertainty in the movement patterns of the stock and the spatial overlap between the NNCES Stock and other bottlenose dolphin stocks in coastal waters. Observer coverage is also limited or non-existent for most of these fisheries, thus stranding data are used as an indicator of fishery-related interactions.

Crab Pots and Other Pots

~~Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, it~~ During 2007-2011, there were 2 reported mortalities of bottlenose dolphins in trap/pot gear that could be assigned to either the Southern Migratory Coastal or NNCES Stocks. During 2007 there was 1 reported mortality entangled in trap/pot gear for which the fishery type could not be confirmed. During 2009 there was 1 reported mortality entangled in blue crab pot gear. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, based on stranding data, it is clear that interactions with pot gear are a common occurrence and result in mortalities of coastal morphotype bottlenose dolphins in some regions (Burdett and McFee 2004).

Mid-Atlantic Gillnet

This fishery has the highest documented level of mortality of coastal morphotype bottlenose dolphins, and the sink gillnet gear in North Carolina is its largest component in terms of fishing effort and observed takes. Of 12 observed mortalities between 1995 and 2000, 5 occurred in sets targeting spiny or smooth dogfish, 1 was in a set targeting "shark" species, 2 occurred in striped bass sets, 2 occurred in Spanish mackerel sets, and the remainder were in sets targeting kingfish, weakfish or finfish generically (~~Rossman and~~ Palka and Rossman 2001). From 2001-2008, 7 additional bottlenose dolphin mortalities were observed in the mid-Atlantic gillnet fishery. Three mortalities were observed in 2001 with 1 occurring off of northern North Carolina during April and 2 occurring off of Virginia during November. Four additional mortalities were observed along the North Carolina coast near Cape Hatteras: 1 in May 2003, 1 in September 2005, 1 in September 2006, and 1 in October 2006. Because the Northern Migratory, Southern Migratory, NNCES~~Northern North Carolina Estuarine System~~ and SNCES~~Southern North Carolina Estuarine System~~ Stocks of bottlenose dolphins ~~stocks~~ all occur in waters off of North Carolina, it is not possible to definitively assign all observed mortalities, or extrapolated bycatch estimates, to a specific stock. In addition, the Bottlenose Dolphin Take Reduction Plan (TRP) was implemented in May 2006 resulting in changes in the gear configurations and other characteristics of the fishery.

To estimate the mortality of bottlenose dolphins in the mid-Atlantic gillnet fishery, the available data were divided into the period from 2002 through April 2006 (pre-TRP) and from May 2006 – 2008 (post-TRP). Three

alternative approaches were used to estimate bycatch rates. First, a generalized linear model (GLM) approach was used similar to that described in Palka and Rossman ~~and Palka~~ (2001). This approach included all observed mortalities from 1995-2008 where the fishing gear was still in use during the period from 2002-2008. Second, a simple ratio estimator of catch per unit effort (CPUE = observed catch / observed effort) was used based directly upon the observed data. Finally, a ratio estimator pooled across years was used to estimate different CPUE values for the pre-TRT and post-TRT periods. In each case, the annual reported fishery effort (represented as reported landings) was multiplied by the estimated bycatch rate to develop annual estimates of fishery-related mortality, again similar to the approach in Rossman and Palka (2001). To account for the uncertainty in the most appropriate of these 3 alternative approaches, the average of the 3 model estimates (and the associated uncertainty) are used to estimate the mortality of bottlenose dolphins for this fishery (Table 1). It should be noted that the extrapolated estimates of total mortality include landings from inshore waters (see North Carolina Inshore fishery section below) where the NNCES Stock is likely to occur.

Table 1. Summary of the 2002-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus*) in the Northern North Carolina Estuarine System Stock in the commercial mid-Atlantic coastal gillnet fisheries. The estimated annual and average mortality estimates are shown for the period prior to the implementation of the Bottlenose Dolphin Take Reduction Plan (pre-TRP) and after the implementation of the plan (post-TRP). Three alternative modeling approaches were used, and the average of the 3 was used to represent mortality estimates. The minimum and maximum estimates indicate the range of uncertainty in assigning observed bycatch to stock. Observer coverage is measured as a proportion of reported landings (tons of fish landed). Data are derived from the Northeast Observer program, NER dealer data, and NCDMF dealer data. Values in parentheses indicated the CV of the estimate.

Period	Year	Observer Coverage[a]	Min Annual Ratio	Min Pooled Ratio	Min GLM	Max Annual Ratio	Max Pooled Ratio	Max GLM
pre-TRP	2002	0.01	0	0	15.64 (0.63)	0	39.45 (0.92)	33.69 (0.38)
	2003	0.01	0	0	11.03 (0.58)	49.46 (0.94)	12.77 (0.92)	19.29 (0.36)
	2004	0.02	0	0	12.10 (0.62)	0	28.46 (0.92)	28.42 (0.34)
	2005	0.03	0	0	11.84 (0.60)	0	22.58 (0.92)	23.01 (0.37)
	Jan-Apr 2006	0.03	0	0	1.40 (0.50)	0	0	1.99 (0.37)
Annual Avg. pre-TRP			Minimum: 3.47 (CV=0.30)			Maximum: 19.79 (CV=0.11)		
post-TRP	May-Dec 2006	0.03	0	0	5.08 (0.42)	73.37 (0.69)	18.84 (0.68)	12.46 (0.36)
	2007	0.03	0	0	8.32 (0.43)	0	24.47 (0.68)	18.77 (0.34)
	2008	0.01	0	0	8.14 (0.42)	0	21.91 (0.68)	16.77 (0.34)
Annual Avg. post-TRP			Minimum: 2.39 (CV=0.25)			Maximum: 18.99 (CV=0.11)		

[a] Observer coverage is reported on an annual basis for the entire fishery as a proportion of the reported tons of fish landed.

During 2001-2008, ~~T~~there ~~have been~~were 3 observed takes in the mid-Atlantic gillnet fishery ~~since 2001~~ that could potentially be assigned to the ~~Northern North Carolina Estuarine System~~NNCES Stock. However, in each of these cases, the take could potentially be assigned to the Southern Migratory Stock since they occurred in near-shore coastal waters of northern North Carolina. Since observed mortalities (and effort) cannot be definitively assigned to a particular stock within certain regions and times of year, the minimum and maximum possible mortality on the NNCES Stock are presented for comparison to PBR (Table 1).

Based upon these analyses, the minimum mortality estimate for the NNCES Stock for the pre-TRP period was 3.47 (CV=0.30) animals per year, and that for the post-TRP period was 2.39 (CV=0.25) animals per year. The maximum estimates were 19.79 (CV=0.11) for the pre-TRP period and 18.99 (CV=0.11) for the post-TRP period (Table 1).

During the last five years (2007-2011), no bottlenose dolphin takes were observed by the Northeast Fishery Observer Program (NEFOP) attributable to the mid-Atlantic gillnet fishery. The average percent federal observer coverage (measured in trips) for this fishery by the NEFOP from 2007-2011 was less than 1% in internal waters (bays, sounds, estuaries), 2.74% in state waters (0-3 miles) and 6.30% in federal waters (3-200 miles). These low levels of coverage are likely insufficient to detect bycatch of coastal bottlenose dolphins in the mid-Atlantic commercial gillnet fishery. Due to a lack of observed takes, no new estimates of mortality in this fishery could be generated, as indicated by the "no estimate" in Table 2 for years 2009-2011. However, serious injury and mortality from this fishery are still occurring based on other documented interactions (see Table 2). Specifically, in 2011, a dead dolphin from the NNCES Stock was recovered in North Carolina by the stranding network entangled around its head and pectoral fin in 2 different pieces of medium mesh commercial gillnet gear likely targeting flounder and spiny dogfish. ~~Also in 2011 the stranding network recovered a dead dolphin from a fisherman who had incidentally caught it in a small mesh gillnet targeting spot in North Carolina. This animal could have belonged to the Southern Migratory Coastal or NNCES Stock.~~ The documented interaction~~s~~ in commercial gear represents a minimum known count of interactions with this fishery in the last 5 years, absent sufficient observer coverage to generate mortality estimates (see Table 2). In addition, 2 incidental takes (mortalities) in research gillnet gear are documented that could have belonged to the NNCES or Southern Migratory Coastal Stocks: (1) in 2009 during a small mesh gillnet research project targeting Spanish mackerel in North Carolina; and (2) in 2010 during a small mesh gillnet research project targeting sharks in North Carolina. All of these are included in the stranding database and the stranding totals in Table 3.

North Carolina Inshore Gillnet fishery

Information about interactions with bottlenose dolphins and the North Carolina inshore gillnet fishery is based on stranding data. Historically, there was no systematic Federal observer coverage of this fishery. However, from May 2010 through March 2012, the NMFS allocated sea days and observed this fishery for the first time. No bycatch was recorded by observers. Because of sea turtle bycatch in inshore gillnets, the North Carolina Division of Marine Fisheries (NCDMF) has operated systematic coverage of the fall (September-December) flounder gillnet fishery (> 5" mesh) in Pamlico Sound as a part of their Incidental Take Permit under the ESA (Byrd *et al.* 2011). In May 2010, NCDMF expanded the observer coverage to include gillnet effort using nets > 4" mesh in most internal state waters and throughout the year, with a goal of 7-10% coverage. No bycatch of bottlenose dolphins has been recorded by observers, although stranding data continue to indicate interactions with this fishery occur. Specifically, stranding data documented 1 mortality in 2010 in commercial gillnet gear that belonged to the NNCES Stock. The dead dolphin was recovered in Roanoke Sound, North Carolina, entangled around its mandible and tongue in commercial gillnet gear (target species unknown). The documented interaction in commercial gear represents a minimum known count of interactions with this fishery in the last five years. In addition, a mortality most likely from the NNCES Stock was observed in 2007 in the small mesh portion of state fishery in a research gillnet in the Neuse River. Both animals were included in the stranding database and are included in Table 3.

Beach Haul Seine/Beach-based Gillnet Gear

Beach-based gillnet gear is now considered part of the mid-Atlantic gillnet fishery and is monitored by the

federal observer program. During 2007-2011, no observed takes or strandings associated with this gear type have been attributed to the NNCES Stock. ~~Two coastal bottlenose dolphin takes were observed in beach haul seine gear: 1 in May 1998 and 1 in December 2000. These takes occurred during a striped bass fishery within the spatial and seasonal range of the Northern Migratory Stock. Beach-based gillnet gear is now considered part of the mid-Atlantic gillnet fishery described above; however, it is not included in the observer program or resulting mortality estimates. Data from the Southeast Region Stranding Network from 2002-2008 include 2 confirmed reports of bottlenose dolphin mortalities in beach-based gillnet gear for striped bass during winter months off the coast of northern North Carolina: 1 in December 2002 and 1 in January 2008. A third possible mortality associated with this gear occurred during December 2002 (Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). Based upon their location and time of year, these mortalities were most likely animals from the Northern Migratory Stock rather than the NNCES Stock since they occurred north of Cape Hatteras in winter months.~~

Crab Pots ~~and Other Pots~~

~~Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, it is clear that interactions with pot gear are a common occurrence and result in mortalities of coastal morphotype bottlenose dolphins in some regions (Burdett and McFee 2004). Southeast Regional Marine Mammal Stranding Network data (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009) from 2004 through 2008 include 13 reports of interactions between bottlenose dolphins and confirmed blue crab pot gear with the majority of these occurring in waters from Florida to South Carolina. In addition, there were 4 interactions documented with pot gear where the fishery could not be confirmed. In these cases, the gear was confirmed to be associated with a pot or trap, but may have been from a fishery other than blue crab (e.g., whelk fisheries in Virginia). Of the confirmed blue crab pot interactions, there was 1 reported mortality in this 5-year period in waters of Virginia and North Carolina. This case occurred in August 2004 and is most likely assigned to the NNCES Stock. There was 1 mortality in pot gear where the fishery type could not be confirmed in Virginia. This mortality was reported in August 2007 and could be assigned to either the Southern Migratory or the NNCES Stock.~~

Virginia and North Carolina Pound Nets

Historical and recent stranding network data report interactions between bottlenose dolphins and pound nets in Virginia. During 2007-2011, 7 bottlenose dolphin strandings which could have belonged to the NNCES Stock were entangled in pound net gear in Virginia (Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 9 November 2012). ~~Stranding data for 2004-2008 indicate 17 cases where bottlenose dolphins were removed from pound net gear, and it was determined that animals were entangled pre-mortem. In each case, the bottlenose dolphin was recovered directly from the fishing gear. Of these 17 cases, 14 were documented mortalities while 3 were released alive (S. Barco, Virginia Aquarium, unpublished data; Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009).~~ An additional 18 dolphins that could have belonged to the NNCES Stock stranded with twisted twine markings indicative of interactions with pound net gear. These interactions occurred primarily inside estuarine waters near the mouth of the Chesapeake Bay and in summer months. ~~Nine of these mortalities occurred during the summer (July-September) when they could have impacted either the Southern Migratory or the Northern North Carolina Estuarine System Stocks.~~ The overall impact of the Virginia Pound Net fishery on the Northern North Carolina Estuarine System Stock is unknown due to the limited information on the stock's movements, particularly whether or not it occurs within waters inside the mouth of the Chesapeake Bay. ~~In addition, 1 bottlenose dolphin was recovered dead from pound net gear in North Carolina during August 2004. This mortality is most likely assigned to the NNCES Stock.~~

Hook and Line Fisheries

During 2007-2011, 2 dolphins in the stranding database that could have belonged to the NNCES Stock were documented as interacting with hook and/or line gear. In 2008 in Virginia, a dolphin that could have belonged to this stock or to the Northern or Southern Migratory Coastal Stocks was documented entangled in hook and line gear. In 2011 in Virginia, a dolphin that could have belonged to this stock or the Southern Migratory Coastal Stock was

documented entangled in hook and line gear. These mortalities were included in the stranding database and are included in the stranding totals presented in Table 3.

Other Mortality

There have been occasional mortalities of bottlenose dolphins during research activities including both directed live capture studies and fisheries surveys. ~~From 2002-2009, there have been 15 reported interactions during research activities resulting in 13 documented mortalities of bottlenose dolphins.~~ A mortality occurring in a turtle relocation trawl off of North Carolina during March 2002 could have been attributed to either the Southern Migratory Stock or the NNCES Stock. ~~One mortality in a research beach seine was reported from June 2007 in northern North Carolina that was consistent with the spatial range of the Northern Migratory Stock, the Southern Migratory Stock or the NNCES Stock. Finally, a~~A mortality was observed in ~~July~~ 2007 in a research gillnet in the Neuse River that is most likely from the NNCES Stock. A second mortality was observed in research gear during 2009 in a Spanish mackerel gillnet. A third mortality was observed in research gear during 2010 in a small mesh gillnet. The second and third mortalities could have belonged to the NNCES or Southern Migratory Stocks. All 3 research gillnet mortalities were included in the stranding database and are included in Table 3.

Three bottlenose dolphins that were captured, tagged with satellite-linked transmitters, and released near Beaufort, North Carolina, during April 2006 by ~~the~~ NMFS as part of a long-term stock delineation research project were believed to have died shortly thereafter as a result of the capture or tagging (NMFS unpublished data). Two of the animals were recovered stranded but because of advanced decomposition of the carcasses cause of death could not be determined. One of these 2 animals was known from long-term photo-ID and was likely of the Southern North Carolina Estuarine System Stock. The third animal has not been observed subsequent to release, but patterns in the data received from its satellite tag were similar to that of the other 2 and indicated the fates were similar. These last 2 animals were, based on satellite-derived locations, most likely from the NNCES Stock. All known human-caused mortalities including both commercial fisheries and research related mortalities are summarized in Table 2.

During 2008, a free-swimming animal in Pamlico Sound was observed with constricting gear wrapped around it, and the animal was considered seriously injured (Maze-Foley and Garrison in prep.). During 2011 another free-swimming animal was observed in the Pamlico River entangled in line and a black float around its peduncle. It was also considered seriously injured (Maze-Foley and Garrison in prep.).

This stock inhabits areas with significant drainage from agricultural, industrial and urban sources, and as such is exposed to contaminants in runoff from those sources. The blubber of 47 bottlenose dolphins captured and released in and around Beaufort contained detectable environmental contaminants, and 7 had unusually high levels of the pesticide methoxychlor (Hansen *et al.* 2004). While there are no estimates of indirect human-caused mortality from pollution or habitat degradation, Schwacke *et al.* (2002) found that the levels of polychlorinated biphenyls (PCBs) observed in Beaufort female bottlenose dolphins would likely impair reproductive success, especially of primiparous females.

~~Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Northern North Carolina Estuarine System Stock. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. The reported mortalities in Virginia Pound Net, beach-based gillnet and crab pot fisheries are confirmed reports and are likely an underestimate of total mortalities in these fisheries.~~

~~Year~~	~~mid-Atlantic Gillnet~~	~~Virginia Pound Net[a]~~	~~Beach-based Gillnet~~	~~Blue Crab Pot~~	~~Other Pot~~	~~Research~~	~~Total~~
~~2004~~	~~Min = 4.0 Max= 18.9~~	~~Min = 1 Max = 4~~	~~0~~	~~1~~	~~0~~	~~0~~	~~Min = 6.0 Max = 23.9~~
~~2005~~	~~Min = 4.0 Max= 15.2~~	~~Min = 0 Max = 1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~Min = 4.0 Max = 16.2~~

~~2006~~	~~Min = 2.2~~ ~~Max = 35.6~~	~~Min = 0~~ ~~Max = 2~~	~~0~~	~~0~~	~~0~~	~~2~~	~~Min = 4.2~~ ~~Max = 39.6~~
~~2007~~	~~Min = 2.8~~ ~~Max = 14.4~~	~~Min = 0~~ ~~Max = 1~~	~~0~~	~~0~~	~~Min = 0~~ ~~Max = 1~~	~~Min = 1~~ ~~Max = 2~~	~~Min = 3.8~~ ~~Max = 18.4~~
~~2008~~	~~Min = 2.7~~ ~~Max = 12.9~~	~~Min = 0~~ ~~Max = 2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~Min = 2.7~~ ~~Max = 14.9~~
~~Annual Average Mortality (2004-2008)~~				~~Minimum Estimated = 4.1~~ ~~Maximum Estimated = 22.6~~			
~~[a] Pound nets also include a mortality observed in North Carolina in 2004.~~							

Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Northern North Carolina Estuarine System Stock during 2007-2011 from observer and stranding data. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. This is especially the case for strandings where the maximum number reported may truly be a minimum because not all strandings are detected. They are therefore reported as the maximum greater than or equal to what was recovered.

Year	**mid-Atlantic Gillnet**		**Virginia Pound Net (strandings and observed)**	**NC Inshore Gillnet (strandings)**	**Beach-based Gillnet (strandings)**	**Blue Crab Pot (strandings)**	**Other Pot (strandings)**	**Hook and Line (strandings)**	**Research (incidental takes)**	**Total**
	Min/Max estimate extrapolated from observer data (only through 2008)	Additional interactions known from stranding data or observer data								
2007	Min = 2.8 Max = 14.4	0	Min = 0 Max = 2	1	0	0	Min = 0 Max = 1	0	1	Min = 4.8 Max ≥ 19.4
2008	Min = 2.7 Max = 12.9	0	Min = 0 Max = 2	0	0	0	0	Min = 0 Max = 1	0	Min = 2.7 Max ≥ 15.9
2009	No estimate	0	Min = 0 Max = 3	0	0	Min = 0 Max = 1	0	0	Min = 0 Max = 1	Min = 0 Max ≥ 5
2010	No estimate	0	0	1	0	0	0	0	Min = 0 Max = 1	Min = 1 Max ≥ 2
2011	No estimate	Min = 1 Max = 2	0	0	0	0	0	Min = 0 Max = 1	0	Min = 1 Max ≥ 3
Annual Average Mortality (2007-2011)					Minimum Estimated = 1.9 Maximum Estimated ≥ 9.1					

Strandings

Between 2004 and 2008, ~~422~~ Between 2007 and 2011, 397 bottlenose dolphins stranded along the Atlantic coast in North Carolina and Virginia that could be assigned to the NNCES Stock (Table 3; Northeast Regional Marine Mammal Stranding Network, Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~21~~13 September 2012 and 9 November 2012~~2009 and 18 November 2009~~). It was not possible to determine whether or not there was evidence of human interaction (HI) for 261 of these strandings, and for 66 it was determined there was no evidence of human interaction. The remaining 70 showed evidence of human interactions (Table 3). Within estuarine waters of North Carolina, where the probability is very high that strandings are from the NNCES Stock, there were a total of 75 strandings in this 5 year period. In most cases, it was not possible to determine if a HI had occurred due to the decomposition state of the stranded animal. Of the 7 (of 75) estuarine strandings positive for HI, 3 (43%) of them exhibited evidence of fisheries entanglement (e.g., entanglement lesions, attached gear). Of the remaining 4 animals, 2 strandings were mutilated, 1 had unidentified line marks, and 1 was an incidental take from research gillnet gear. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point.

The assignment of animals to a particular stock is impossible in some seasons and regions, particularly in coastal waters of North Carolina and Virginia. Therefore, it is likely that the counts below include some animals from either the Southern Migratory Coastal or Northern Migratory Coastal Stocks, and some of the strandings below were also included in the counts for the Southern Migratory Coastal and Northern Migratory Coastal Stocks. ~~In addition, s~~Stranded carcasses are not routinely identified to either the offshore or coastal morphotype of bottlenose dolphin, therefore it is possible that some of the reported strandings were of the offshore form. ~~Within estuarine waters of North Carolina, where the probability is very high that strandings are from the NNCES Stock, there were a total of 73 strandings in this 5 year period. In addition, stranded carcasses are not routinely identified to either the offshore or coastal morphotype of bottlenose dolphin, therefore it is possible that some of the reported strandings were of the offshore form. In most cases, it was not possible to determine if a human interaction had occurred due to the decomposition state of the stranded animal. However, in cases where a determination could be made, the incidence of evidence of fisheries interactions was high. In cases where a determination could be made, 65% of stranded animals from Virginia, 41% of cases from coastal waters of North Carolina and 82% (14/17) of cases from North Carolina estuarine waters had evidence of human interaction. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks).~~

~~Table 3. Strandings of bottlenose dolphins from North Carolina and Virginia that can possibly be assigned to the Northern North Carolina Estuarine System (NNCES) Stock. Strandings observed in North Carolina are separated into those occurring within Pamlico Sound and other estuaries (Estuary) vs. coastal waters. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, particularly in coastal waters, there is likely overlap between the NNCES Stock and other bottlenose dolphin stocks. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009~~

~~State~~	~~2004~~			~~2005~~			~~2006~~			~~2007~~			~~2008~~		
~~Type~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~
~~North Carolina Coastal~~	~~6~~	~~8~~	~~25~~	~~7~~	~~7~~	~~41~~	~~1~~	~~7~~	~~25~~	~~5~~	~~8~~	~~26~~	~~5~~	~~5~~	~~28~~
~~North Carolina Estuary~~	~~6~~	~~1~~	~~9~~	~~2~~	~~0~~	~~7~~	~~4~~	~~2~~	~~11~~	~~2~~	~~0~~	~~19~~	~~0~~	~~0~~	~~10~~

~~Virginia[a]~~	~~13~~	~~5~~	~~10~~	~~7~~	~~9~~	~~13~~	~~9~~	~~3~~	~~17~~	~~6~~	~~3~~	~~19~~	~~8~~	~~1~~	~~22~~
~~Annual Total~~	~~83~~			~~93~~			~~79~~			~~88~~			~~79~~		

~~[a] Strandings from Virginia include primarily waters inside Chesapeake Bay during late summer through fall. It is likely that the NNCES Stock overlaps with the Southern Migratory Stock in this area.~~

Table 3. Strandings of bottlenose dolphins from North Carolina and Virginia that can possibly be assigned to the Northern North Carolina Estuarine System (NNCES) Stock. Strandings observed in North Carolina are separated into those occurring within Pamlico Sound and other estuaries (Estuary) vs. coastal waters. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, particularly in coastal waters, there is likely overlap between the NNCES Stock and other bottlenose dolphin stocks. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 (SER) and 9 November 2012 (NER).

State	**2007**			**2008**			**2009**			**2010**			**2011**		
Type	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD
North Carolina-Estuary	2[a]	0	19	0	0	11	2[b]	0	8	2[c]	2	19	1[d]	1	8
North Carolina - Coastal	5[e]	8	26	6[f]	4	26[g]	6[h]	3	19	4[i]	18	18	7[j]	20	25
Virginia[k]	6[l]	3	19	8[m]	1	22	12[n]	2	12	4[o]	2	16	5[p]	2	13
Annual Total	88			78			64			85			82		

[a] Includes 1 mutilation and 1 incidental take in research gillnet gear.
[b] Includes 1 mutilation.
[c] Includes 2 fisheries interactions (FI).
[d] Includes 1 FI which was also mutilated.
[e] Includes 4 FIs
[f] Includes 6 FIs. One animal had also been mutilated, and another animal had also been boat struck.
[g] Includes 1 mass stranding of 2 animals.
[h] Includes 5 FIs, 1 of which was also boat struck. Also includes 1 incidental take in gillnet research gear. The research gear was a Spanish mackerel commercial fishing gillnet.
[i] Includes 3 FIs and 1 incidental take in research experimental gillnet gear targeting shark.

[j] Includes 4 FIs and 1 mutilation.
[k] Strandings from Virginia include primarily waters inside Chesapeake Bay during late summer through fall. It is likely that the NNCES Stock overlaps with the Southern Migratory Stock in this area.
[l] Includes 6 FIs. Two animals (mortalities) were entangled in VA pound nets. One animal (mortality) had trap/pot gear wrapped around its fluke.
[m] Includes 7 FIs and 1 mutilation. Two FIs were animals (mortalities) entangled in VA pound nets and 1FI was an animal (mortality) entangled in hook and line gear.
[n] Includes 12 FIs, 3 of which were animals (mortalities) entangled in VA pound nets.
[o] Includes 2 FIs and 1 boat strike.
[p] Includes 5 FIs, one of which was an animal (mortality) entangled in hook and line gear. One FI was also mutilated.

STATUS OF STOCK

~~From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event, and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the total human-caused mortality and serious injury is greater than 10% of PBR and may exceed PBR, ~~the~~ NMFS considers the NNCES Stock to be a strategic stock under the Marine Mammal Protection Act. PBR for the NNCES Stock is 7.9 and so the zero mortality rate goal, 10% of PBR, is 0.8. The documented annual average human-caused mortality for this stock for 2007 – 2011 ranges between a minimum of 1.9 and a maximum of 9.1. However, the total U.S. human-caused mortality and serious injury for this stock cannot be directly estimated because of the spatial overlap of several stocks of bottlenose dolphins in this area. In addition, there are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and therefore, cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

~~The status of the NNCES Stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. The annual average of human-caused mortality for this stock ranges between a minimum of 4.1 and a maximum of 22.6, but this is an underestimate of total mortality associated with commercial fisheries. The calculated PBR is 7.9 animals; therefore, it is possible that mortality in commercial fisheries exceeds PBR for this stock. However, because mortality cannot be reliably assigned to stocks, it is currently not possible to evaluate the status relative to PBR. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. However, the total human-caused mortality and serious injury is most likely greater than 10% of PBR and may exceed PBR. Because relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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~~November 2010~~

COMMON BOTTLENOSE DOLPHIN *(Tursiops truncatus truncatus)*
Southern North Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting primarily coastal waters near the shore and those present primarily in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (e.g., Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (e.g., Wells *et al.* 1987). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data).~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005; Balmer *et al.* 2008).

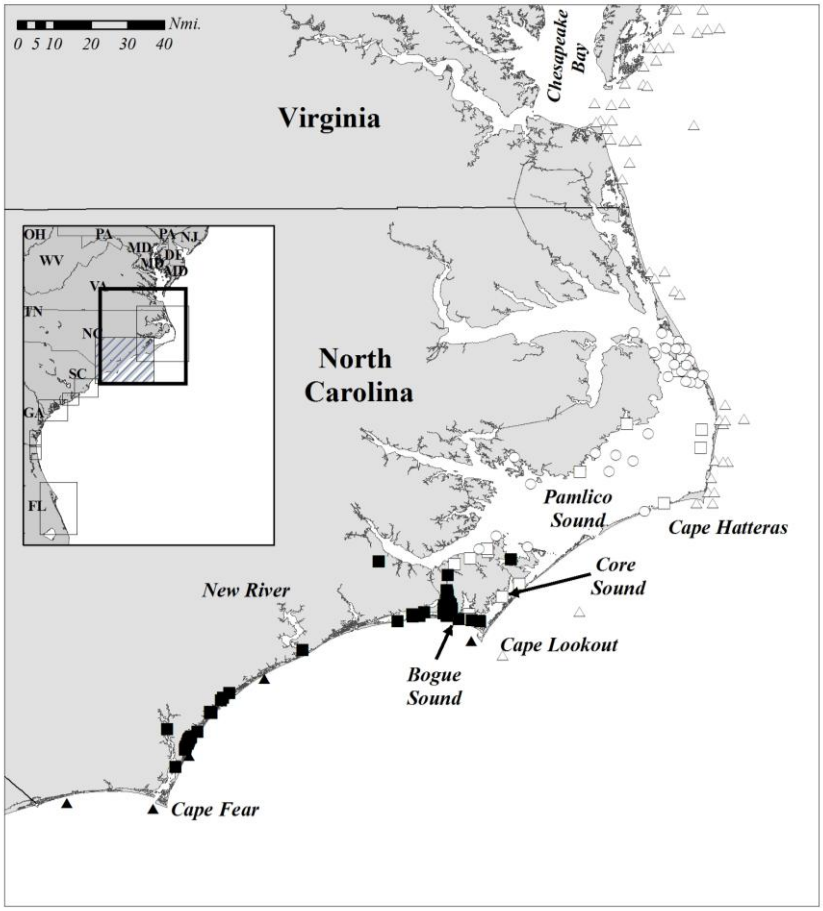

Figure 1. *The ~~summer (July-September)~~ distribution of bottlenose dolphins occupying coastal and estuarine waters in North Carolina and Virginia during the period July-September. Locations are shown from aerial surveys (triangles), satellite telemetry (circles) and photo-identification studies (squares). Sightings assigned to the Southern North Carolina Estuarine System stock are shown with filled symbols (all fall within hatched box in inset map). Photo-identification data are courtesy of Duke University and the University of North Carolina at*

The Southern North Carolina Estuarine System (SNCES) ~~s~~Stock is best defined as animals occupying estuarine and nearshore coastal waters (< 3 km from shore) between the ~~North Carolina/South Carolina border~~Little River Inlet Estuary, inclusive of the estuary (near the North Carolina/South Carolina border), and the New River during ~~winter~~cold water months. ~~that~~Members of this stock do not undertake large-~~-~~scale migratory movements. Instead, they expand their range only slightly northward during warmer months into estuarine waters and nearshore waters (< 3 km) of southern North Carolina as far as central Core Sound, and

possibly southern Pamlico Sound.

The movements and range of this stock have been inferred from a combination of photo-ID, tag telemetry and genetic data. Two animals were tagged at Holden Beach, just south of Cape Fear during November 2004, and they remained within waters of southern and central North Carolina throughout the 9-month period when their tags were operational (NMFS unpublished data). Animals captured and released near Beaufort, North Carolina, were fitted with satellite-linked transmitters and/or freeze-branded during July 1995 (30 animals; Hansen and Wells 1996), November 1999 (11 animals), April 2000 (12 animals) and April 2006 (19 animals) (Hohn and Hansen, NMFS unpublished data). Long-term photo-ID studies that have been conducted in waters of North Carolina include records of some of these animals (Read *et al.* 2003; NMFS 2001; Urian *et al*. unpublished manuscript; Duke University unpublished data; University of North Carolina at Wilmington unpublished data; NMFS unpublished data). Of these tagged or freeze-branded animals, at least 8 have been documented to have moved south and occupied estuarine and coastal waters near Cape Fear, south of the New River during cold water months. In addition, genetic analysis of samples from animals in waters of southern North Carolina (between Cape Lookout and the North Carolina/South Carolina border) demonstrate significant genetic differentiation from animals occupying waters from Virginia and further north and waters of South Carolina (Rosel *et al.* 2009).

The movements of animals from the SNCES Stock are distinct from those of the Northern North Carolina Estuarine System Stock (NNCES). During warm water months, NNCES animals occupy waters of central and northern Pamlico Sound and nearshore coastal waters (< 1 km from shore) perhaps as far north as the Chesapeake Bay. It is probable that there is spatial overlap between these two estuarine stocks during this time in the waters near Beaufort, North Carolina. However, SNCES Stock animals were not observed to move north of Cape Lookout in coastal waters nor into the main portion of Pamlico Sound during summer (NMFS unpublished data; Duke University unpublished data; University of North Carolina at Wilmington unpublished data). These movement patterns are consistent with resights of individual dolphins during a photo-ID study that sampled much of the estuarine waters of North Carolina (Read *et al.* 2003). Read *et al.* (2003) suggested that movement patterns, differences in group sizes, and habitats are consistent with 2 stocks of animals occupying estuarine waters of North Carolina.

In summary, during warm water months the SNCES Stock occupies estuarine and nearshore coastal waters (< 3 km from shore) between the Little River at the North Carolina/South Carolina border and Core Sound, including Bogue Sound and southern Pamlico Sound (Figure 1). In the northern portion of its range during these months, it likely overlaps with the NNCES Stock. During cold water months this stock is found only within the southern portion of this range, from the Little River Inlet estuary at the North Carolina/South Carolina border to the New River. In coastal waters (< 3 km from shore), it may overlap with the Southern Migratory Stock during this period. The timing of the seasonal contraction of the range (and expansion) likely occurs with some inter-annual variability related to seasonal changes in water temperatures and/or prey availability.

In prior stock assessment reports, the animals within this region were referred to as the "Southern North Carolina" coastal stock during summer months, and were part of the winter "mixed" North Carolina management unit of coastal bottlenose dolphins (Waring *et al.* 2009). However, they are now recognized as a distinct stock based upon these differences in seasonal ranging patterns and genetic analyses.

~~Their range includes estuarine waters near Cape Fear and inshore waters of the Intracoastal Waterway along the southern North Carolina coast during fall and winter months (November–February). The ranging patterns of bottlenose dolphins in photo-ID studies supports the presence of a group of dolphins within these waters that are distinct from both dolphins occupying estuarine and coastal waters in northern North Carolina and animals from the Northern and Southern Migratory stocks that occupy coastal waters of North Carolina at certain times of the year (Read *et al.* 2003; NMFS 2001; NMFS unpublished data). In addition, genetic analysis of samples from animals in waters of southern North Carolina (between Cape Lookout and the North Carolina/South Carolina border) demonstrate significant differentiation from animals occupying waters from Virginia and further north and waters of South Carolina (NMFS 2001; Rosel *et al.* 2009). In prior stock assessment reports, the animals within this region were referred to as the "Southern North Carolina" coastal stock during summer months, and were part of the winter "mixed" North Carolina management unit of coastal bottlenose dolphins (Waring *et al.* 2009). However, they are now recognized as a distinct stock based upon these differences in seasonal ranging patterns and genetic analyses.~~

~~The seasonal movements of the SNCES stock are best described using a combination of tag telemetry and long-term photo-ID studies. Animals captured and released near Beaufort, North Carolina, were fitted with satellite-linked transmitters during November 1999 (3 animals), April 2000 (8 animals) and April 2006 (5 animals) (NMFS unpublished data). In addition, long-term photo-ID studies have been conducted in waters of North Carolina that~~

~~include records of both these tagged animals and animals that were captured and freeze-branded near Beaufort, North Carolina, during summer months (Duke University unpublished data; University of North Carolina at Wilmington unpublished data; NMFS unpublished data). Two animals were tagged at Holden Beach, just south of Cape Fear during November 2004, and they remained within waters of North Carolina throughout the 9-month period when their tags were operational (NMFS unpublished data). Of the tagged or freeze-branded animals, 8 occupied estuarine and coastal waters near Cape Fear during winter months (January-February) and hence were identified as belonging to the SNCES stock. The seasonal movements of these animals are presumed to represent the range of the SNCES stock. During winter through late spring (December–May) the SNCES stock occurs primarily within the waters of southern North Carolina south of the New River. This includes both estuarine, Intracoastal Waterway and nearshore coastal waters. During summer through early fall (July-October), the stock moves north along the North Carolina coast and occupies waters of Bogue Sound, Core Sound and southern Pamlico Sound (Figure 1).~~

~~The movements of animals from the SNCES stock are distinct from those of the Northern North Carolina Estuarine System stock (NNCES). During summer and fall, NNCES animals occupy waters of northern Pamlico Sound and nearshore coastal waters perhaps as far north as the Chesapeake Bay. It is probable that there is spatial overlap between these two estuarine stocks during late summer and fall in the waters near Beaufort. However, SNCES stock animals were not observed to move north of Cape Lookout in coastal waters nor into the main portion of Pamlico Sound during summer (NMFS unpublished data; Duke University unpublished data; University of North Carolina at Wilmington unpublished data). These movement patterns are consistent with those in resights of individual dolphins during a photo-ID study that sampled much of the estuarine waters of North Carolina (Read *et al.* 2003). Read *et al.* (2003) suggested that movement patterns, differences in group sizes, and habitats are consistent with two stocks of animals occupying estuarine waters of North Carolina. Finally, genetic analysis of samples from animals in waters of southern North Carolina (between Cape Lookout and the North Carolina/South Carolina border) demonstrate significant differentiation from animals occupying waters from Virginia and further north and waters of South Carolina (Rosel *et al.* 2009).~~

~~In summary, during summer and fall months (July-October), the SNCES stock occupies estuarine and nearshore coastal waters (< 3km from shore) between the North Carolina/South Carolina border and Core Sound (Figure 1). It likely overlaps with the Northern North Carolina Estuarine System stock in the northern portion of its range during late summer. During late fall through spring, the SNCES stock moves south to waters near Cape Fear. In coastal waters, it overlaps with the Southern Migratory stock during this period.~~

~~Dolphins residing in the estuaries south of this stock between the North Carolina/South Carolina border and the northern boundary of the Charleston Estuarine System stock (CES) are not currently covered in any stock assessment report. There are insufficient data to determine whether animals in this region exhibit affiliation to the CES stock or to the SNCES stock, or if there are one or more estuarine stocks in this region. It should be noted, however, that in this intervening region during 2003-2007, there were 11 recorded bottlenose dolphin strandings, 2 of which were confirmed fishery interactions. One of these 2 was entangled in crab pot gear, disentangled and released alive. Of the remaining 9 stranded dolphins, evidence of human interaction could not be determined for 4 and 5 were determined not to have had any human interaction (Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009).~~

POPULATION SIZE

The best available abundance estimate for the SNCES Stock is 188 animals (CV=0.19, 95% Confidence Interval=118-257) based upon photo-ID mark-recapture surveys in 2006 (Urian *et al*., unpublished manuscript). This estimate is potentially negatively biased as the survey area covered waters out to 1km from shore but the stock boundary includes waters out to 3 km from shore.

Earlier abundance estimates

Read *et al.* (2003) provided the first ~~and only available comprehensive~~ abundance estimate ~~of~~for bottlenose dolphins that occur within the ~~proposed~~ boundaries of the SNCES ~~s~~Stock. This estimate ~~is~~was based on a photographic mark-recapture survey of North Carolina waters inshore of the barrier islands, conducted during July 2000. Read *et al.* (2003) estimated the number of animals in the inshore waters of North Carolina ~~equivalent to that of~~occupied by the SNCES ~~s~~Stock at 141 (95% CI 112 - 200, CV=0.15). However, this estimate is more than 8 years old, and hence cannot be used to calculate N_{min} or PBR.

Since both tag-telemetry studies and photo-ID records indicate that some portion of the SNCES ~~s~~Stock occurs in coastal waters between the North Carolina/South Carolina border and Cape Lookout during summer months, it is appropriate to include animals from summer aerial surveys of these areas in the abundance estimate. Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. The surveys employed two observer teams operating independently on the same aircraft to derive a correction for~~estimate~~ visibility bias. Abundance estimates were calculated using line-transect methods and distance analysis (Buckland *et al.* 2001). ~~The 2002 surveys included two teams of observers to derive a correction for visibility bias.~~ The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct-duplicate estimator (Palka 1995).

During the summer 2002 aerial survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia/Florida state line. A total of 185 bottlenose dolphin groups were sighted during summer including 2,544 individual animals.

In summer 2004, an ~~additional~~ aerial survey was conducted between central Florida and New Jersey~~ was conducted~~. As with the 2002 survey~~s~~, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were a total of 140 sightings of bottlenose dolphin groups including 3,093 individual animals. During the summer of 2004, water temperatures were significantly cooler than those during 2002 and earlier surveys conducted in 1995, and animals were distributed farther south~~ and overlapped spatially~~. Therefore, ~~I~~it is probable that both the Northern Migratory and Southern Migratory ~~s~~Stocks occurred in waters of northern North Carolina during the summer of 2004.

The best abundance estimate for the Southern North Carolina Estuarine System ~~s~~Stock in coastal waters is ~~therefore~~considered to be from the summer 2002 survey when there was less overlap among stocks. Survey data were post-stratified to estimate the abundance of dolphins within a strip extending from the shoreline to 3km from shore between the North Carolina/South Carolina border and Cape Lookout, North Carolina. Tag-telemetry records indicated that SNCES animals rarely ventured further away from shore. ~~However, animals from the Southern Migratory stock may occur within this strip during summer months. Therefore, the estimate of abundance within this strip likely includes both SNCES animals and Southern Migratory animals and hence overestimates the abundance.~~ The resulting ~~best~~ abundance estimate for the Southern North Carolina Estuarine System ~~s~~Stock in coastal waters ~~is~~was 2,454 (CV=0.53). However, animals from the Southern Migratory Coastal Stock may occur within this 3-km strip during summer months. Therefore, the estimate of abundance within this strip likely included both SNCES animals and Southern Migratory Coastal animals and hence overestimated the abundance of the SNCES Stock.

~~The best available abundance estimate for the SNCES stock is the combined abundance from estuarine and coastal waters. This combined estimate is 2,595 (CV=0.28). However, this estimate includes data that are more than 8 years old from Read *et al.* (2003). Retaining only the portion of this estimate that is less than 8 years old, the best estimate is the aerial survey from coastal waters only since it accounts for approximately 95% of the stock. Thus, the best estimate of stock abundance is 2,454 (CV=0.53), but this is clearly an underestimate of total abundance since it excludes estuarine waters.~~

Recent surveys and abundance estimates

A photo-ID mark-recapture study was conducted in 2006 using similar methods to those in Read *et al.* (2003) and included estuarine waters of North Carolina from the North Carolina/South Carolina border to Albemarle Sound. The survey also included coastal waters extending up to 1km from shore. A boundary line between the NNCES Stock and the neighboring SNCES Stock was identified at 34°46’ N Latitude in central Core Sound, and this boundary is consistent with the descriptions of the ranges of the 2 stocks during summer months. The resulting abundance estimate included a correction for the proportion of dolphins with non-distinct fins in the population. The abundance estimate for the SNCES Stock based upon photo-ID mark-recapture surveys in 2006 was 188 animals (CV=0.19, 95% Confidence Interval=118-257; Urian *et al.*, unpublished manuscript). This is the best available abundance estimate for the SNCES Stock, but is probably negatively biased as the survey covered waters only to 1km from shore.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997~~b~~). The best estimate for the Southern North Carolina Estuarine System stock of bottlenose dolphins is ~~2,454 (CV=0.53)~~188 (CV=0.19). The resulting minimum population estimate is ~~1,614~~160.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the SNCES ~~s~~Stock of bottlenose dolphins is 160~~unknown~~. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the SNCES ~~s~~Stock is therefore 1.6~~16~~. ~~However, this is an underestimate since the abundance estimate excludes the estuarine waters occupied by this stock.~~

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total estimated average annual fishery mortality of the SNCES Stock ranges between a minimum of 0.2 and a maximum of 0.8 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

The SNCES Stock has the potential to interact with 1 Category I fishery and 4 Category II fisheries: the mid-Atlantic gillnet fishery (Category I), Atlantic blue crab trap/pot fishery, North Carolina long haul seine fishery, North Carolina roe mullet stop net, and North Carolina inshore gillnet fishery. The SNCES Stock may also interact with 1 Category III fishery: the Atlantic Ocean commercial passenger fishing vessel (hook and line) fishery. The magnitude of the interactions with these fisheries is unknown because of both uncertainty in the movement patterns of the stock and the spatial overlap between the SNCES Stock and other bottlenose dolphin stocks in coastal waters. Observer coverage is also limited or non-existent for most of these fisheries, thus stranding data are used as an indicator of fishery-related interactions. ~~The SNCES stock interacts with 3 Category II fisheries: the Atlantic blue crab trap/pot fishery, North Carolina long haul seine fishery and North Carolina inshore gillnet fishery. There is no systematic observer coverage of these fisheries by the National Marine Fisheries Service (NMFS), although the North Carolina Division of Marine Fisheries operates systematic coverage of the fall flounder gillnet fishery in Pamlico Sound (Price 2008). As a result, information about interactions with North Carolina inshore fisheries is based solely on stranding data and it is not possible to estimate the annual number of interactions or mortalities in these fisheries. The SNCES stock may also interact with the mid-Atlantic gillnet fishery. The magnitude of the interaction with this fishery is unknown because of both uncertainty in the movement patterns of the stock and the spatial overlap between the SNCES stock and other bottlenose dolphin stocks in coastal waters. The total estimated~~

~~average annual fishery mortality on the SNCES stock ranges between a minimum of 0.6 and a maximum of 1.2 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.~~

Mid-Atlantic Gillnet

This fishery has the highest documented level of mortality of coastal morphotype bottlenose dolphins, and ~~the~~ sink gillnet gear in North Carolina is its largest component in terms of fishing effort and observed takes. Of 12 observed mortalities between 1995 and 2000, 5 occurred in sets targeting spiny or smooth dogfish, 1 was in a set targeting "shark" species, 2 occurred in striped bass sets, 2 occurred in Spanish mackerel sets, and the remainder were in sets targeting kingfish, weakfish or finfish generically (~~Rossman and~~ Palka and Rossman 2001). From 2001 to 2008, 7 additional bottlenose dolphin mortalities were observed in the mid-Atlantic gillnet fishery. Three mortalities were observed in 2001 with 1 occurring off of northern North Carolina during April and 2 occurring off of Virginia during November. Four additional mortalities were observed along the North Carolina coast near Cape Hatteras: 1 in May 2003, 1 in September 2005, 1 in September 2006 and 1 in October 2006. Because the Northern Migratory, Southern Migratory, Northern North Carolina Estuarine System, and Southern North Carolina Estuarine System bottlenose dolphin stocks all occur in waters off of North Carolina, it is not possible to definitively assign all observed mortalities, or extrapolated bycatch estimates, to a specific stock. In addition, the Bottlenose Dolphin Take Reduction Plan (BDTRP) was implemented in May 2006 resulting in changes in the gear configurations and other characteristics of the fishery.

To estimate the mortality of bottlenose dolphins in the mid-Atlantic gillnet fishery, the available data were divided into the period from 2002 through April 2006 (pre-BDTRP) and from May 2006–2008 (post-BDTRP). Three alternative approaches were used to estimate bycatch rates. First, a generalized linear model (GLM) approach was used similar to that described in ~~Rossman and~~ Palka and Rossman (2001). This approach included all observed mortalities from 1995 to 2008 where the fishing gear was still in use during the period from 2002 to 2008. Second, a simple ratio estimator of catch per unit effort (CPUE = observed catch / observed effort) was used based directly upon the observed data. Finally, a ratio estimator pooled across years was used to estimate different CPUE values for the pre-BDTRP and post-BDTRP periods. In each case, the annual reported fishery effort (represented as reported landings) was multiplied by the estimated bycatch rate to develop annual estimates of fishery-related mortality, again similar to the approach in ~~Rossman and~~ Palka and Rossman (2001). To account for the uncertainty in the most appropriate of these 3 alternative approaches, the average of the 3 model estimates (and the associated uncertainty) are used to estimate the mortality of bottlenose dolphins for this fishery (Table 1).

Table 1. Summary of the 2002-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus truncatus*) in the Southern North Carolina Estuarine System ~~s~~Stock in the commercial mid-Atlantic gillnet fisheries. The estimated annual and average mortality estimates are shown for the period prior to the implementation of the Bottlenose Dolphin Take Reduction Plan (pre-BDTRP) and after the implementation of the plan (post-BDTRP). Three alternative modeling approaches were used, and the average of the 3 was used to represent mortality estimates. The minimum and maximum estimates indicate the range of uncertainty in assigning observed bycatch to stock. Observer coverage is measured as a proportion of reported landings (tons of fish landed). Data are derived from the Northeast Observer program, NER dealer data and NCDMF dealer data. Values in parentheses indicated the CV of the estimate.

Period	Year	Observer Coverage[a]	Min Annual Ratio	Min Pooled Ratio	Min GLM	Max Annual Ratio	Max Pooled Ratio	Max GLM
pre-BDTRP	2002	0.01	0	0	1.77 (0.35)	0	0	4.36 (0.30)
	2003	0.01	0	0	3.12 (0.42)	0	0	4.71 (0.34)
	2004	0.02	0	0	2.77 (0.43)	0	0	6.51 (0.36)

	2005	0.03	0	0	1.43 (0.41)	0	0	2.34 (0.30)
	Jan-Apr 2006	0.03	0	0	0.01 (0.70)	0	0	0.32 (0.42)
Annual Avg. pre-BDTRP			Minimum: 0.61 (CV=0.22)			Maximum: 1.22 (CV=0.18)		
post-BDTRP	May-Dec 2006	0.03	0	0	2.23 (0.51)	0	0	2.83 (0.41)
	2007	0.03	0	0	1.88 (0.52)	0	0	2.88 (0.37)
	2008	0.01	0	0	1.42 (0.48)	0	0	2.56 (0.32)
Annual Avg. post-BDTRP			Minimum: 0.61 (CV=0.30)			Maximum: 0.92 (CV=0.21)		

[a] Observer coverage is reported on an annual basis for the entire fishery as a proportion of the reported tons of fish landed.

During 2001-2008 ~~T~~there ~~have been~~were no observed mortalities in the mid-Atlantic gillnet fishery ~~since 2001~~ that could potentially be assigned to the Southern North Carolina Estuarine System ~~s~~Stock. Hence, both the annual and pooled ratio estimators of bycatch rate were equal to 0 in both the pre-BDTRP and post-BDTRP periods. Since the GLM approach includes information from prior to 2002, positive bycatch rates for the SNCES ~~s~~Stock were estimated (Table 1). Since observed mortalities (and effort) cannot be definitively assigned to a particular stock within certain regions and times of year, the minimum and maximum possible mortality of the SNCES ~~s~~Stock are presented for comparison to PBR (Table 1).

Based upon these analyses, the minimum mortality estimate for the SNCES ~~s~~Stock for the pre-BDTRP period was 0.61 (CV=0.22) animals per year, and that for the post-BDTRP period was also 0.61 (CV=0.30) animals per year. The maximum estimates were 1.22 (CV=0.18) for the pre-BDTRP period and 0.92 (CV=0.21) for the post-BDTRP period (Table 1).

During the last five years (2007-2011), no bottlenose dolphin takes were observed by the Northeast Fishery Observer Program (NEFOP) attributable to the mid-Atlantic gillnet fishery. The average percent federal observer coverage (measured in trips) for this fishery by the NEFOP from 2007-2011 was less than 1% in internal waters (bays, sounds, estuaries), 2.74% in state waters (0-3 miles) and 6.30% in federal waters (3-200 miles). These low levels of coverage are likely insufficient to detect bycatch of coastal bottlenose dolphins in the mid-Atlantic commercial gillnet fishery. Due to a lack of observed takes, no new estimates of mortality in this fishery could be generated, as indicated by the "no estimate" in Table 2 for years 2009-2011. However, serious injury and mortality from this fishery are still occurring based on other documented interactions (see Table 2). Specifically, in 2011 the stranding network recovered a dead dolphin from a fisherman who had incidentally caught it in a small-mesh gillnet targeting spot in North Carolina. This animal could have belonged to the SNCES or Southern Migratory Coastal Stock. This documented interaction in commercial gear represents a minimum known count of interactions with this fishery in the last 5 years, absent sufficient observer coverage to generate mortality estimates (see Table 2).

North Carolina Inshore Gillnet fishery

Information about interactions with bottlenose dolphins and the North Carolina inshore gillnet fishery is based on stranding data. Historically, there was no systematic Federal observer coverage of this fishery. However, from May 2010 through March 2012, the NMFS allocated sea days and observed this fishery for the first time, but future NMFS coverage is uncertain due to funding. No bycatch was recorded by observers. Because of sea turtle bycatch in inshore gillnets, the North Carolina Division of Marine Fisheries (NCDMF) has been operating their own observer program of the inshore gillnet fishery. Since 2000, the NCDMF has operated systematic coverage of the fall

(September-December) flounder gillnet fishery (> 5" mesh) in Pamlico Sound as a part of their Incidental Take Permit under the ESA (Byrd *et al.* 2011). In May 2010, NCDMF expanded the observer coverage to include gillnet effort using nets > 4" mesh in most internal state waters and throughout the year, with a goal of 7-10% coverage. No bycatch of bottlenose dolphins has been recorded by observers, although stranding data continue to indicate interactions with this fishery occur.

Crab Pots and Other Pots

During 2007-2011, there was 1 reported mortality, in 2009, of a bottlenose dolphin entangled in blue crab pot gear that could have belonged to the SNCES or Southern Migratory Coastal Stock. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, based on stranding data, it is clear that interactions with pot gear are a common occurrence and result in mortalities of coastal morphotype bottlenose dolphins in some regions (Burdett and McFee 2004). ~~Southeast Regional Marine Mammal Stranding Network data (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009) from 2004 through 2008 include 13 reports of interactions between bottlenose dolphins and confirmed blue crab pot gear with the majority of these occurring in waters from Florida to South Carolina. In addition, there were 4 interactions documented with pot gear where the fishery could not be confirmed. In these cases, the gear was confirmed to be associated with a pot or trap, but may have been from a fishery other than blue crab (e.g., whelk fisheries in Virginia). There were no reported interactions that were likely to impact the SNCES stock during 2004-2008.~~

Other Mortality

There have been occasional mortalities of bottlenose dolphins during research activities including directed live capture studies, turtle relocation trawls and fisheries surveys. From 2002 to 2009, there have been 15 reported interactions during research activities resulting in 13 documented mortalities of bottlenose dolphins. One mortality was reported from October 2006 in a fishery research trawl that was most likely from the SNCES ~~s~~Stock.

Three bottlenose dolphins that were captured, tagged with satellite-linked transmitters, and released near Beaufort, North Carolina, during April 2006 by ~~the~~ NMFS as part of a long-term stock delineation research project were believed to have died shortly thereafter as a result of the capture or tagging (NMFS unpublished data). Two of the animals were recovered stranded but because of advanced decomposition of the carcasses cause of death could not be determined. One of these two animals was known from long-term photo-ID and was likely of the Southern North Carolina Estuarine System ~~s~~Stock. The third animal has not been observed subsequent to release, but patterns in the data received from its satellite tag were similar to that of the other two and indicated the fates were similar. These last two animals were, based on satellite-derived locations, most likely from the NNCES ~~s~~Stock. All known human-caused mortalities including both commercial fisheries and research related mortalities are summarized in Table 2.

This stock inhabits areas with significant drainage from agricultural, industrial and urban sources, and as such is exposed to contaminants in runoff from those sources. The blubber of 47 bottlenose dolphins captured and released in and around Beaufort, North Carolina, contained contaminants of some level, and 7 had unusually high levels of the pesticide methoxychlor (Hansen *et al.* 2004). While there are no estimates of indirect human-caused mortality from pollution or habitat degradation, Schwacke *et al.* (2002) found that the levels of polychlorinated biphenyls (PCBs) observed in Beaufort female bottlenose dolphins would likely impair reproductive success, especially of primiparous females.

~~Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Southern North Carolina Estuarine System stock. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. The reported mortalities in crab pot fisheries are confirmed reports and are likely an underestimate of total mortalities in these fisheries.~~

~~Year~~	~~Mid-Atlantic Gillnet~~	~~Blue Crab Pot~~	~~Other Pot~~	~~Research~~	~~Total~~

~~2004~~	~~Min = 0.9~~ ~~Max = 2.2~~	~~0~~	~~0~~	~~0~~	~~Min = 0.9~~ ~~Max = 2.2~~
~~2005~~	~~Min = 0.5~~ ~~Max = 0.8~~	~~0~~	~~0~~	~~0~~	~~Min = 0.5~~ ~~Max = 0.8~~
~~2006~~	~~Min = 0.7~~ ~~Max = 1.1~~	~~0~~	~~0~~	~~2~~	~~Min = 0.7~~ ~~Max = 1.1~~
~~2007~~	~~Min = 0.6~~ ~~Max = 1.0~~	~~0~~	~~0~~	~~0~~	~~Min = 0.6~~ ~~Max = 1.0~~
~~2008~~	~~Min = 0.5~~ ~~Max = 0.9~~	~~0~~	~~0~~	~~0~~	~~Min = 0.5~~ ~~Max = 0.9~~
~~Annual Average Mortality (2004-2008)~~			~~Minimum Estimated = 0.6~~ ~~Maximum Estimated = 1.2~~		

Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Southern North Carolina Estuarine System Stock during 2007-2011 from observer and stranding data. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. This is especially the case for strandings where the maximum number reported may truly be a minimum because not all strandings are detected. They are therefore reported as the maximum greater than or equal to what was recovered.

Year	**Mid-Atlantic Gillnet**		**NC Inshore Gillnet (strandings)**	**Blue Crab Pot (strandings)**	**Other Pot (strandings)**	**Research (incidental takes)**	**Total**
	Min/Max estimate extrapolated from observer data (only through 2008)	Additional interactions known from stranding data					
2007	Min = 0.6 Max = 1.0	0	0	0	0	0	Min = 0.6 Max ≥ 1.0
2008	Min = 0.5 Max = 0.9	0	0	0	0	0	Min = 0.5 Max ≥ 0.9
2009	No estimate	0	0	Min = 0 Max = 1	0	0	Min = 0 Max ≥ 1
2010	No estimate	0	0	0	0	0	0
2011	No estimate	Min = 0 Max = 1	0	0	0	0	Min = 0 Max ≥ 1

Annual Average Mortality (2007-2011)	Minimum Estimated = 0.2 Maximum Estimated ≥ 0.8

Strandings

Between 2004 and 2008, ~~78~~ Between 2007 and 2011, 58 bottlenose dolphins stranded in coastal and estuarine waters of North Carolina that could be assigned to the SNCES ~~s~~Stock (Table 3; Northeast Regional Marine Mammal Stranding Network, Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012 ~~21 September 2009 and 18 November 2009~~). It was not possible to determine whether or not there was evidence of human interaction for 24 of these strandings, and for 16 it was determined there was no evidence of human interaction. The remaining 18 showed evidence of human interactions, including 15 fisheries interactions (FI) and 1 mutilation. One FI was a 2009 mortality resulting from entanglement in blue crab pot gear. Another FI was a 2011 mortality resulting from a gillnet entanglement. The gillnet was targeting spot, and falls under the mid-Atlantic gillnet fishery. The remaining FIs could not be assigned to a specific fishery. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point.

The assignment of animals to a particular stock is impossible in some seasons and regions. In particular, there is overlap between the SNCES ~~s~~Stock and the Southern Migratory Coastal ~~s~~Stock in coastal waters of southern North Carolina during fall and spring. There is also overlap in southern Pamlico Sound and waters of Bogue Sound with the NNCES ~~s~~Stock during late summer and early fall. Therefore, it is likely that the counts below include some animals from either the Southern Migratory Coastal or NNCES ~~s~~Stock, and some of the strandings below were also included in the counts for the Southern Migratory Coastal and NNCES Stocks. Within estuarine waters of southern North Carolina, where the probability is very high that strandings are from the SNCES ~~s~~Stock, there were a total of ~~18~~14 strandings in this 5 year period. In addition, stranded carcasses are not routinely identified to either the offshore or coastal morphotype of bottlenose dolphin, therefore it is possible that some of the reported strandings were of the offshore form. ~~In most cases, it was not possible to determine if a human interaction had occurred due to the decomposition state of the stranded animal. However, in cases where a determination could be made, the incidence of evidence of fisheries interactions was high in coastal waters. In cases where a determination could be made, 47% of cases from coastal waters of North Carolina and 25% (2/8) of cases from North Carolina estuarine waters had evidence of human interaction. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks) or evidence of a boat strike, gunshot wound, mutilation, etc., at some point in the animal's life. Evidence of fishery interaction is by far the most common type of human interaction reported.~~

Table 3. Strandings of bottlenose dolphins from North Carolina that can possibly be assigned to the Southern North Carolina Estuarine System Stock. Strandings observed in North Carolina are separated into those occurring within estuaries vs. coastal waters. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, particularly in coastal waters, there is likely overlap between the SNCES Stock and other bottlenose dolphin stocks. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012.

State	**2007**			**2008**			**2009**			**2010**			**2011**		
Type	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD
North Carolina - Coastal	2[a]	1	5	3[b]	3	4	3[c]	2	1	3[d]	3	2	5[e]	4	3

North Carolina - Estuary	0	1	2	0	0	2	0	0	2	2[f]	1	2	0	1	1
Annual Total	11			12			8			13			14		

[a] Includes 2 fisheries interactions (FI).
[b] Includes 3 FIs.
[c] Includes 3 FIs, 1 of which was an entanglement interaction (mortality) with blue crab pot gear.
[d] Includes 1 FI and 1 mutilation.
[e] Includes 4 FIs, 1 of which was a gillnet entanglement mortality from the mid-Atlantic gillnet fishery.
[f] Includes 2 FIs, 1 of which was also mutilated.

~~Table 3. Strandings of bottlenose dolphins from North Carolina that can possibly be assigned to the Southern North Carolina Estuarine System stock. Strandings observed in North Carolina are separated into those occurring within estuaries vs. coastal waters. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, particularly in coastal waters, there is likely overlap between the SNCES stock and other bottlenose dolphin stocks. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009.~~

~~State~~	~~2004~~			~~2005~~			~~2006~~			~~2007~~			~~2008~~		
~~Type~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~	~~HI Yes~~	~~HI No~~	~~CBD~~
~~North Carolina - Coastal~~	~~4~~	~~8~~	~~10~~	~~3~~	~~4~~	~~4~~	~~2~~	~~3~~	~~2~~	~~3~~	~~1~~	~~5~~	~~4~~	~~2~~	~~5~~
~~North Carolina - Estuary~~	~~1~~	~~1~~	~~3~~	~~0~~	~~0~~	~~1~~	~~0~~	~~4~~	~~2~~	~~1~~	~~1~~	~~1~~	~~0~~	~~0~~	~~3~~
~~Annual Total~~	~~27~~			~~12~~			~~13~~			~~12~~			~~14~~		

STATUS OF STOCK

~~From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the total human-caused mortality and serious injury is equal to or greater than 10% of PBR and may exceed PBR, ~~the~~ NMFS considers the SNCES Stock to be a strategic stock under the Marine Mammal Protection Act. PBR for the SNCES Stock is 1.6 and so the zero mortality rate goal, 10% of PBR, is 0.2.

The documented annual average human-caused mortality for this stock for 2007 – 2011 ranges between 0.2 and 0.8. However, the total U.S. human-caused mortality and serious injury for this stock cannot be directly estimated because of the spatial overlap of several stocks of bottlenose dolphins in this area. In addition, there are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality, and the total fishery-related mortality and serious injury for this stock is unlikely to be less than 10% of the calculated PBR and cannot be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock. ~~The status of the SNCES stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. The annual average of human-caused mortality for this stock ranges between a minimum of 0.6 and a maximum of 1.2, but this is an underestimate of total mortality associated with commercial fisheries. The most recent abundance estimate is an underestimate of stock size because it excludes estuarine waters. Based upon the available data, it seems unlikely that mortality in commercial fisheries exceeds PBR. However, the total human-caused mortality and serious injury is most likely greater than 10% of PBR. Because of uncertainty in both stock size and mortality and because relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Northern South Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters. Photo-identification (photo-ID) studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Sloan 2006; Litz *et al.* 2012), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

Estuarine waters of central South Carolina are characterized by tidal salt marsh around Bulls Bay and the Cape Romain National Wildlife Refuge, and inlets leading to smaller marsh systems, such as at Murrells Inlet. This region has minimal industrial development. Much of the habitat is a shallow, meso-tidal (2-4 m tidal range) estuary consisting of deep channels, creeks, bays and inlets with tidal mud flats and oyster reefs navigable only at high tide (Petricig 1995; Dame *et al.* 2000; Young and Phillips 2002; Sloan 2006).

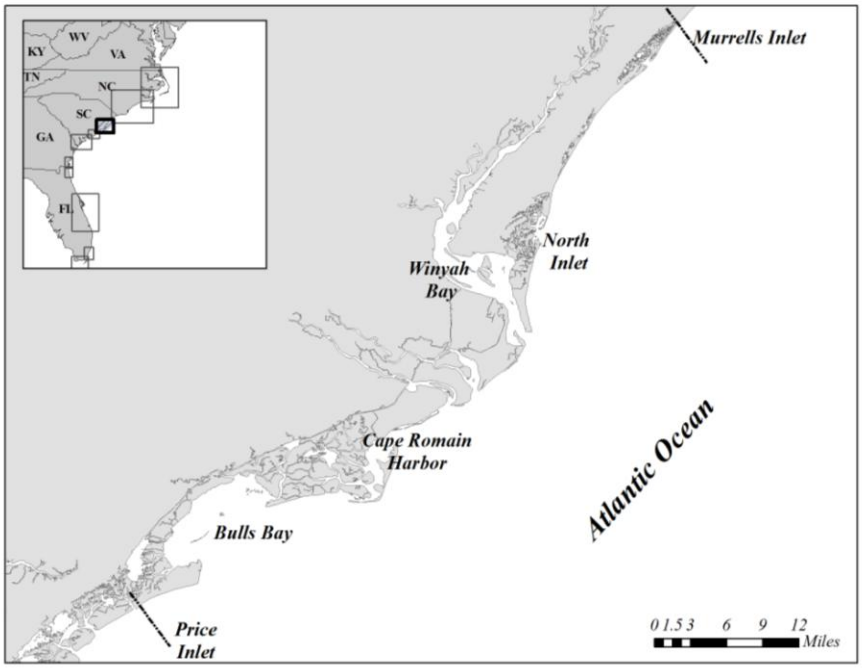

Figure 1. *Geographic extent of the Northern South Carolina Estuarine System (NSCES) Stock. The borders are denoted by dashed lines.*

Sloan (2006) analyzed photo-ID data collected between April-September 2002, July-August 2003 and September 2003 through August 2005 in the Cape Romain National Wildlife Refuge. In total, 1,900 bottlenose dolphins were recorded during 445 sightings, with 121 individuals identified. Only 36% of individuals had dorsal fins that were considered identifiable. Twenty-two year-round residents (sighted 4-20 times and in all 4 water temperature classes: <13°C (cool), 13-19°C (cool transitional), 20-27°C (warm transitional) and >27°C (warm)), 49 seasonal residents (sighted in 1-3 temperature classes over multiple years or 3 temperature classes in the same year), and 50 transients were identified. Sloan (2006) noted that 3 of the 49 seasonal residents were sighted 10-19 times each, and may be residents missed during months with less survey effort. All year-round residents were sighted exclusively within the salt marsh and never in the coastal waters. Twelve year-round residents showed long-term site-fidelity, with 10 individuals sighted over 3 years and 2 individuals sighted over 4 years. Seasonal shifts in abundance were seen and were attributed to shifts in abundance and behavior of prey species (Sloan 2006).

More recently, Brusa (2012) conducted photo-ID surveys in Winyah Bay and North Inlet, South Carolina, to the north of Cape Romain, to examine distribution and home ranges. During May 2011 - February 2012, Brusa (2012) identified 84 dolphins sighted 3 or more times on non-consecutive days, with 71 of those sighted during the warm season (May-October), 2 during the cold season (December-February), and 11 during warm and cold seasons. Similar to Cape Romain, dolphins were present in warm and cold seasons, but found to be less abundant during the cold season. During the warm season, 3 dolphins were sighted in North Inlet only, 38 dolphins in Winyah Bay only, and 41 dolphins were sighted in both North Inlet and Winyah Bay.

Six dolphins identified in the Cape Romain area were matched via the mid-Atlantic Bottlenose Dolphin Catalog (Urian *et al.* 1999) to animals seen in estuarine waters of Winyah Bay and/or North Inlet, one of which had an extensive year-round sighting history in these northern estuarine waters (Sloan 2006). One dolphin seen in the Cape Romain area was also sighted in Murrells Inlet, South Carolina, north of North Inlet (Sloan 2006). However, this animal was sighted only once and so it is difficult to know whether it was an estuarine animal or simply a coastal dolphin that explored these two areas.

Given the results of these photo-ID studies, the Northern South Carolina Estuarine System (NSCES) Stock is delimited as dolphins inhabiting estuarine waters from Murrells Inlet, South Carolina, southwest to Price Inlet, South Carolina, the northern boundary of Charleston Estuarine System Stock (Figure 1). Dolphins may be present as far inland as the Intracoastal Waterway and the stock boundary also includes coastal waters up to 1 km offshore. Murrells Inlet is a small estuarine area and likely does not support its own stock of bottlenose dolphins, but could be utilized by estuarine dolphins from further south. As a result, the stock boundaries for the NSCES Stock include the North Inlet estuary north to Murrells Inlet. North of Murrells Inlet, South Carolina, there is a long stretch of sandy beach with few inlets and no significant estuarine waters. However, these boundaries are subject to change upon further study of dolphin residency patterns in estuarine waters of South Carolina.

POPULATION SIZE

The total number of bottlenose dolphins residing within the NSCES is unknown. Based on photo-ID data from April-September 2002, July-August 2003, and September 2003-August 2005, 121 individually identified dolphins were observed in the Cape Romain National Wildlife Refuge (Sloan 2006), which included 22 year round residents, 49 seasonal residents and 50 transient dolphins. Some of the dolphins classified as seasonal residents may actually be year round residents that were missed in one temperature class during the surveys, as they were observed repeatedly over multiple years. Sloan (2006) observed relative abundance to increase with sea surface temperature (higher during March-November), and to decrease during months of lowest sea surface temperature (December-February). Based on photo-ID data collected during May 2011-February 2012, 71 warm-season (May-October) residents, 2 cold-season (December-February) residents, and 11 warm- and cold-season residents were observed in Winyah Bay and North Inlet (Brusa 2012). As in Cape Romain, relative abundance in Winyah Bay/North Inlet was higher during warmer months. It is important to note that survey effort from each study, in Cape Romain and in Winyah Bay/North Inlet, only covered a small portion of the entire geographic range of this stock.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the NSCES Stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the NSCES Stock is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks or stocks of unknown

status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR is unknown for this stock of bottlenose dolphins.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total estimated annual human-caused mortality and serious injury within the NSCES during 2007-2011 is unknown. One mortality occurred during 2011 due to an interaction with the Southeast Atlantic inshore gillnet fishery; however, it is not possible to estimate the total number of interactions or mortalities associated with the inshore gillnet fishery since there is no systematic observer program.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998~~,~~; Andersen *et al*. 2008~~,~~; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is the potential for the NSCES Stock to interact with the Category II Southeast Atlantic inshore gillnet and Atlantic blue crab trap/pot fisheries (Appendix III).

Gillnet Gear

One mortality occurred during 2011 due to an interaction with the Southeast Atlantic inshore gillnet fishery. Another mortality occurred during 2008 as the result of an incidental take in a monofilament gillnet during a research project on coastal sharks. Both of these mortalities were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, 13 September 2012) .

Crab Pots

One of the largest commercial fisheries in South Carolina's coastal waters is the Atlantic blue crab (*Callinectes sapidus*) fishery, which operates year round with the predominant fishing occurring from August to November. Burdett and McFee (2004) reviewed bottlenose dolphin strandings in South Carolina from 1992 to 2003 and found that 24% of the 42 entanglements of dolphins were associated with crab pots with an additional 19% of known entanglements deemed as probable interactions with crab pots.

During 2007-2011 there were no documented interactions with crab pots in the NSCES area. It should be noted that there is no systematic observer program for the blue crab fishery.

Other Mortality

From 2007 to 2011, 7 stranded bottlenose dolphins were reported within the NSCES area, including the above mentioned 2 fisheries interactions with gillnet gear (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, 13 September 2012). Of the 5 remaining strandings, for 1 dolphin, there was no evidence of human interactions, and for 4 dolphins, it was not possible to make a determination of human interactions. Stranding data underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

An Unusual Mortality Event (UME) was declared in South Carolina during February-May 2011. One stranding assigned to the NSCES Stock was considered to be part of the UME. The cause of this UME is still under investigation.

STATUS OF STOCK

Bottlenose dolphins in the western North Atlantic are~~**Error! Bookmark not defined.**~~ not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the NSCES stock is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, ~~the~~ NMFS

considers this to be a strategic stock under the Marine Mammal Protection Act. The documented annual average human-caused mortality for this stock for 2007 – 2011 is 0.2. However, there are several commercial fisheries, including crab trap/pot fisheries, operating within this stock's boundaries, and these fisheries have little to no observer coverage. The impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, but has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this stock.

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April 2013
~~December 2009~~

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Charleston Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. ~~Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2007), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports.~~ Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002a; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). ~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

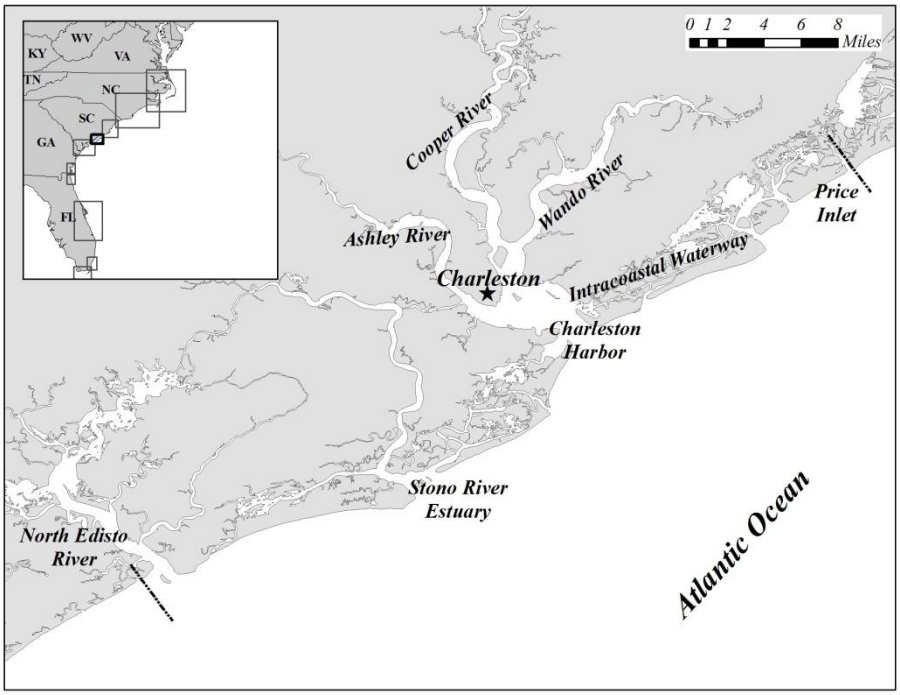

Figure 1. *Geographic extent of the Charleston Estuarine System (CES) stock. Dashed lines denote the boundaries.*

~~The Charleston Estuarine System (CES) sStock is centered near Charleston, South Carolina. It is bounded in the north by Price Inlet and includes a stretch of the Intracoastal Waterway (ICW) approximately 13 km east-northeast of Charleston Harbor. It continues through Charleston Harbor and includes the main channels and selected creeks of the Ashley, Cooper and Wando Rivers. The CES sStock also includes the Stono River Estuary, approximately 20 km south-southwest of Charleston Harbor, the North Edisto River another 20km to the west-southwest, and the estuarine waters and tributaries of these rivers. Finally, the CES Stock also includes 1 km of nearshore coastal waters from Price Inlet to the North Edisto River (Figure 1). The southern boundary abuts the northern boundary of the Northern Georgia/Southern South Carolina Estuarine System sStock, previously defined based on a photo-ID project (Gubbins 2002a,b,c). The borders of this region are defined based on long-term photo-ID studies and telemetry work (Speakman *et al.* 2006; Adams *et al.* 2008; Laska *et al.* 2011). The CES sStock boundaries are subject to change upon further study of dolphin~~

~~residence~~y patterns in estuarine waters of North Carolina, South Carolina and Georgia.

The estuarine habitat within and around the Charleston, South Carolina, area is comprised of both developed and undeveloped areas. The Ashley, Cooper and Wando Rivers and the Charleston Harbor are characterized by a high degree of land development and urban areas whereas the Stono River Estuary and North Edisto River have a much lower degree of development. The Charleston Harbor area includes a broad open water habitat, while the other areas consist of river channels and tidal creeks. The Intracoastal Waterway (ICW) ~~area~~ consists of miles of undeveloped salt marshes interspersed with developed suburban areas, and it has the least amount of open water habitat.

~~Using photo-ID data, Speakman *et al.* (2006) considered a dolphin to be a resident to the area if it was observed during all 4 seasons, regardless of year. Seasonal residents were defined as those observed during the same season in consecutive years, but not in intervening seasons, while transients were only observed during 1 season or in 2 consecutive seasons. It is thought that the seasonal residents and transients may be coastal animals that occasionally or seasonally use estuarine habitats. There is evidence from photo-ID studies that resident dolphins in this stock may also use the coastal waters to move between areas, but that resident estuarine animals are distinct from animals that reside in coastal waters or use coastal waters during seasonal migrations (Speakman *et al.* 2006).~~

Zolman (2002) analyzed photo-ID data collected in the Stono River Estuary from October 1994 through January 1996 and identified a number of year-round resident dolphins using this area. Zolman (2002) indicated ~~the~~little likelihood that the Stono River Estuary included the entire home range of a dolphin~~ was small~~, as individual resident dolphins were observed in other areas, including the North Edisto River and Charleston Harbor.

Satellite telemetry of two female dolphins captured in the Stono River Estuary in October 1999 supported these photo-ID findings. The tag on each dolphin remained functional through January 2000. The first female, along with her dependent calf, visited Charleston Harbor immediately post-capture and later made several forays west to the vicinity of the North Edisto River but for the most part restricted her movements to the lower Stono River Estuary. In contrast, the second female moved frequently between the Stono River Estuary and Charleston Harbor, but not beyond these two areas. These results illustrate the limited range of these ~~many CES~~ dolphins and the connective nature of the areas within the Charleston region (NOAA/NOS/NCCOS unpublished data). Over 30 ~~putative CES~~additional dolphins have ~~also~~ been fitted with VHF tags as a part of capture-release health assessments in 1999 (7 dolphins), 2003 (12 dolphins), and 2005 (16 dolphins). Dolphins were captured in the Stono River Estuary, Charleston Harbor, and the Ashley and Wando Rivers. Tagged dolphins were readily relocated within the confines of the ~~CES~~Charleston estuarine system and were regularly tracked up to 93 days post-release (NOAA/NOS/NCCOS unpublished data). Again these data underscore the resident nature of ~~CES Stock~~ dolphins in this region.

Speakman *et al.* (2006) summarized studies carried out from 1994-2003 on bottlenose dolphins throughout~~ the CES~~ the~~, incorporating the above studies.~~ Charleston estuarine system~~.~~. Individual identifications were made for 839 dolphins, with 115 (14%) sighted between 11 and 40 times. Eighty-one percent (81%) of the 115 individuals were sighted over a period exceeding 5 years while 44% were sighted over a period of 7.7-9.8 years, suggesting long-term residency for some of the dolphins in th~~e CES s~~~~Stock~~is area. Using adjusted sighting proportions to correct for unequal survey effort, 42% of the dolphins showed a strong fidelity for a particular area. Among the individuals sighted at least once in the coastal area, 3% were seen only in the coastal area, 62% were seen in the coastal and one other area, 27% were seen in 2 other areas and 8% were seen in 3 additional areas. This finding, that 97% of the dolphins with high sighting frequencies were observed in at least 2 areas, supports the inclusion of the entire ~~CES~~ area as ~~1~~ a single stock, as opposed to multiple stocks (Speakman *et al.* 2006). The number of dolphins observed in Charleston Harbor was 50% greater than in the Stono River Estuary, at least 40% higher than in the North Edisto River and approximately 9 times greater than in the ICW, illustrating that Charleston Harbor is a high use area for this stock (Speakman *et al.* 2006). Also, findings~~There is evidence~~ from photo-ID studies indicated that resident dolphins in this stock may ~~also~~ use the coastal waters to move between areas, but that resident estuarine animals are distinct from animals that reside in coastal waters or use coastal waters during seasonal migrations (Speakman *et al.* 2006).

Laska *et al.* (2011) ~~-~~investigated movements of dolphins between estuarine and coastal waters in the Charleston estuarine system~~CES~~ area by conducting boat-based, photo-ID surveys along 33 km of nearshore coastal waters adjacent to the Stono River Estuary and Charleston Harbor during 2003-2006. Sighting locations as well as all historical (1994-2002) sighting locations were used to classify individuals into a coastal (60% or more of sightings in coastal waters) or estuarine (60% or more of sightings in estuarine waters) community. Most dolphins (68%) identified during the study were classified as coastal, 22% were classified as estuarine, and the remaining 10% showed no preference. Estuarine dolphins were sighted along the coast 1-15 times; the majority of estuarine

dolphins (74%) were sighted 1-4 times. The majority (69%) of sightings along the coast were mixed groups of estuarine and coastal dolphins. This study demonstrated that the resident ~~CES Stock~~animals utilize~~s~~ nearshore coastal waters as well as estuarine waters, and that estuarine and coastal dolphins frequently interact in this area (Laska *et al.* 2011).~~Telemetry studies of bottlenose dolphins in this area followed 2 females from October 1999 to January 2000 (Hansen, pers. comm.; NOAA/NOS/NCCOS unpublished data). One female was captured and tagged in the Stono River Estuary along with her dependent calf. She moved briefly to Charleston Harbor then to the North Edisto River before returning to the Stono River Estuary. The second female was also captured and tagged in the Stono River Estuary and moved frequently between this estuary and Charleston Harbor. These results illustrate the connective nature of the areas within the Charleston region.~~

The Charleston Estuarine System (CES) Stock is therefore centered near Charleston, South Carolina. It is bounded ~~in~~to the north by Price Inlet and includes a stretch of the ~~Intracoastal Waterway (ICW)~~ICW approximately 13 km east-northeast of Charleston Harbor. It continues through Charleston Harbor and includes the main channels and creeks of the Ashley, Cooper and Wando Rivers. The CES Stock also includes all estuarine waters from the Stono River Estuary, approximately 20 km south-southwest of Charleston Harbor, to the North Edisto River another 20km to the west-southwest, and all estuarine waters and tributaries of these rivers. Finally, the CES Stock also includes 1 km of nearshore coastal waters from Price Inlet to the North Edisto River (Figure 1). The southern boundary abuts the northern boundary of the Northern Georgia/Southern South Carolina Estuarine System Stock, previously defined based on a photo-ID project (Gubbins 2002a,b,c). The ~~borders~~boundaries of the~~is~~ CES Stock ~~region~~ are defined based on long-term photo-ID studies and telemetry work (Speakman *et al*. 2006; Adams *et al.* 2008; Laska *et al.* 2011). ~~-~~The CES Stock boundaries are subject to change upon further study of dolphin residence patterns in estuarine waters of North Carolina, South Carolina and Georgia.

~~Dolphins are known to reside in the estuaries north of this stock between Price Inlet, South Carolina, and the North Carolina/South Carolina border, and are not currently covered in any stock assessment report. During surveys in August 1999, a group of 25-30 dolphins consistently occupied Winyah Bay, South Carolina, with 5 individuals resighted multiple times (Young and Phillips 2002). Treating the North Inlet and Winyah Bay as a closed population, mark-recapture analyses yielded a population estimate of 47.4 (95% confidence interval of 39.0-60.6). Sloan (2006) surveyed the Cape Romaine National Wildlife Refuge area from September 2003 through August 2005 and identified 22 year-round residents, 49 seasonal residents and 50 transient dolphins. Petricig (1995) also documented year-round residents in the estuarine waters of Bull Creek. There are insufficient data to determine whether animals in this region exhibit affiliation to the CES stock or to the stock to the north, the Southern North Carolina Estuarine System stock, or should be delineated as their own stock(s). Further research is needed to establish affinities of dolphins in this region. It should be noted, however, that in this intervening region during 2003-2007, there were 11 recorded bottlenose dolphin strandings, 2 of which were confirmed fishery interactions. One of these 2 was entangled in crab pot gear, disentangled and released alive. Of the remaining 9 stranded dolphins, it could not be determined if there was evidence of human interactions for 4 animals, and no evidence of human interactions was found for 5 animals.~~

POPULATION SIZE

~~The total number of bottlenose dolphins residing within the CES stock is unknown. Since 1994, 839 dolphins have been identified in 5 areas of the CES by Speakman *et al.* (2006). This number includes dolphins that are in the coastal morphotype stock and are transients or seasonal residents to this area, as opposed to the estuarine dolphins found in the rivers and marshes of the CES. Therefore a population size cannot be determined from this study. Analyses to calculate abundance estimates from 2004-2006 mark-recapture analyses, which will yield seasonal, if not annual, abundance estimates for this stock, are being conducted by NOAA/NOS/NCCOS.~~Speakman *et al.* (2010) conducted seasonal (January, April, July, October), photo-ID, mark-recapture surveys during 2004-2006 in the estuarine and coastal waters near Charleston including the Stono River Estuary, Charleston Harbor, and the Ashley, Cooper and Wando Rivers. Pollock's robust design model was applied to the mark-recapture data to estimate abundance. Estimates were adjusted to include the 'unmarked' as well as 'marked' portion of the population for each season. Winter estimates provided the best estimate of the resident estuarine population as transient animals are not thought to be present during winter. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates greater than 8 years old are deemed unreliable, and therefore, 2004 abundance estimates were not included. The average abundance from January 2005 and January 2006 was 289 (CV=0.03). It is important to note this estimate did not cover the entire range of the CES Stock, and therefore the abundance estimate is negatively biased.

Minimum Population Estimate

~~stock of bottlenose dolphins.~~The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). Though negatively biased, the best estimate for the CES Stock is 289 (CV=0.03). The resulting minimum population estimate is 281.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the CES ~~s~~Stock of bottlenose dolphins is 281~~unknown~~. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for this stock of bottlenose dolphins is 2.8~~unknown~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the CES ~~s~~Stock during ~~2003-2007~~2007-2011 is unknown. Interactions were documented with crab pot gear; however, it is not possible to estimate the total number of interactions or mortalities associated with crab pots since there is no systematic observer program.~~It is not possible to estimate the total number of interactions or mortalities associated with crab pots since there is no systematic observer program. However, it is clear that this interaction is a common occurrence in this area and does result in mortalities of estuarine bottlenose dolphins (Burdett and McFee 2004).~~

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the CES Stock to interact with the Category II Atlantic blue crab trap/pot fishery (Appendix III). The only documented reports of fishery-related mortality or serious injury to this stock are associated with the blue crab trap/pot fishery.

Crab Pots

One of the largest commercial fisheries in South Carolina's coastal waters is the Atlantic blue crab (*Callinectes sapidus*) fishery, which operates year round with the predominant fishing occurring from August to November. Burdett and McFee (2004) reviewed bottlenose dolphin strandings in South Carolina from 1992 to 2003 and found that 24% of the 42 entanglements of dolphins were associated with crab pots with an additional 19% of known

~~Table 1. Stranded bottlenose dolphins recovered in the Charleston Estuarine System, South Carolina, from 2003 to 2007, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (accessed 10 November 2008). Please note human interaction does not necessarily mean the interaction caused the animal's death.~~

entanglements deemed as probable interactions with crab pots.

~~Between 2003 and 2007, 5 stranded bottlenose dolphins recovered in the CES displayed evidence of interaction with a crab pot (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). During 2003, 2 bottlenose dolphins were observed entangled in crab pot lines in the CES, including 1 that was released alive and has been resighted at least 9 times (NOAA/NOS/NCCOS unpublished data.). From 2004 to 2006, 4 bottlenose dolphins in the CES stranded entangled in crab pots. These animals were released alive from entangling gear and were not believed to be seriously injured. An additional dolphin stranded in 2007 had wound marks around the tail stock which might be attributable to interactions with crab pots.~~Between 2007 and 2011, 1 bottlenose dolphin in the CES interacted with a crab pot (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). This animal was disentangled from crab pot gear and released alive without serious injury during 2011 (Maze-Foley and Garrison in prep.). The released animal was included in the stranding database (see Table 1). From 2004 to 2006, 4 bottlenose dolphins in the CES were entangled in crab pot gear. These animals were released alive from entangling gear and were not believed to be seriously injured. During 2003, 2 bottlenose dolphins were observed entangled in crab pot lines in the CES, including 1 that was released alive and has been resighted at least 43 times as of December 2012 (NOAA/NOS/NCCOS unpublished data).

Other Mortality

~~In addition to the dolphins reported caught in crab pots, 59 stranded bottlenose dolphins were recovered between 2003 and 2007 in the CES (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008; Table 1). It was not possible to determine whether or not there was evidence of human interactions for 23 of these strandings.~~There were 84 strandings reported in the CES during 2007-2011 (NOAA National Marine Mammal Health and Stranding Response Database, unpublished data, accessed 13 September 2012; Table 1). Evidence of human interaction was found for 5 animals (2 of the 5 had evidence of a fisheries interaction); no evidence of human interaction was found for 41 animals; and for the remaining 40 animals, it could not be determined if there was evidence of human interaction. In addition there was an at-sea observation in 2007 of a calf with a strap around its head, and this animal was considered to be seriously injured (Maze-Foley and Garrison in prep.). Stranding data underestimate the extent of human-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in human interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement, boat-strike or other human interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interactions.

	2003	2004	2005	2006	2007	TOTAL
Total Stranded	15	12	10	13	14	64
Human Interaction						
Fishery Interaction	2	2	2	3	0	9
Other	0	1	0	0	1	2
No Human Interaction	8	5	3	5	9	30
CBD	5	4	5	5	4	23

Table 1. Bottlenose dolphin strandings occurring in the Charleston Estuarine System, South Carolina from 2007 to 2011, as well as number of strandings for which evidence of human interactions was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interactions. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2007	2008	2009	2010	2011	Total
Charleston Estuarine System	Total Stranded	16	9	14	23	24[c]	86
	Human Interaction						
	---Yes	1[a]	0	0	2[b]	2[d]	5
	---No	10	1	6	11	13	41
	---CBD	5	8	8	10	9	40

[a] This carcass was mutilated post-mortem by a member of the public.
[b] This total includes 1 animal that was disentangled and released alive with serious injuries due to interaction with unidentified fishing gear (Maze-Foley and Garrison in prep.).
[c] This total includes 10 animals that were part of the 2011 UME event in South Carolina.
[d] This total includes 1 animal (mortality) struck by a boat, and 1 that was disentangled from crap pot gear and released alive, without serious injury (Maze-Foley and Garrison in prep.).

An Unusual Mortality Event (UME) was declared in South Carolina during February-May 2011. Ten strandings assigned to the CES Stock were considered to be part of the UME. The cause of this UME is still under investigation. Stranded carcasses are not routinely identified to estuarine or coastal stocks of bottlenose dolphins. In order to address whether a stranded dolphin in the CES was from this estuarine stock or the coastal morphotype stock, the photo-ID catalog of all dolphins individually identified ~~since~~from 1994 through 2012 in the Charleston area was checked against any strandings in the CES for which the animal could be identified (Table 2). ~~Seventeen~~Thirty-one (14%) of the ~~123~~215 stranded dolphins were identifiable, ~~12 (71%)~~24 (77%) of which had been previously identified as resident estuarine dolphins belonging to the CES ~~s~~Stock (NOAA/NOS/NCCOS unpublished data). ~~Five~~Seven additional dolphins (~~29~~23%) were identifiable but did not match any dolphins in the Charleston catalog and were thus considered to be part of the coastal morphotype stock. Sixty-seven percent of the estuarine dolphins stranded in the estuarine areas and ~~80~~86% of the coastal non-resident dolphins stranded along the coast. These limited data indicate that coastal dolphins (not considered part of this stock) stranded predominantly along the coast, whereas 2/3 of the estuarine resident dolphins in this stock stranded in the estuarine areas.

~~Table 2. Strandings of individually identified bottlenose dolphins observed in the Charleston Estuarine System stock. Represented are the number (and percentage) of identified dolphins relative to where the stranding occurred. Unpublished data from NOAA/NOS/NCCOS.~~

	# Dolphins Stranded	# Stranded in Estuary	# Stranded on Coast
Estuarine Dolphins	12	8/12 (67%)	4/12 (33%)

~~**Coastal Dolphins**~~	~~5~~	~~1/5 (20%)~~	~~4/5 (80%)~~
~~**Total Dolphins**~~	~~17~~	~~9/17 (53%)~~	~~8/17 (47%)~~

~~Stranding data underestimate the extent of fishery related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.~~

There have been occasional mortalities of bottlenose dolphins during research activities including both directed dolphin capture-release studies and fisheries surveys. In August 2002, a dolphin became entangled in a trammel net and died during a fisheries research project in the Wando River~~, South Carolina~~ (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). A second dolphin was also involved in the incident and may also have died (NOAA/NOS/NCCOS unpublished data). During August 2004, 1 female bottlenose dolphin died during a health assessment capture study in Charleston.

This stock inhabits areas of high human population densities, where a large portion of the stock's range is highly industrialized or agricultural. Strandings in South Carolina were greater near urban areas and those with agricultural input, suggesting adverse health effects to estuarine dolphins in these developed areas (McFee and Burdett 2007).

Numerous studies have investigated the health status and risks for bottlenose dolphins in the CES. Reduced immune response was correlated with increasing ~~whole blood~~ concentrations of several contaminants in bottlenose dolphins from the Charleston area (Kannan *et al.* 1997). ~~Significantly higher total mercury was found in adult females than juvenile females while the highest manganese levels were found in juvenile females. Total mercury concentrations were significantly correlated with age, while the inverse was true for copper, manganese, lead, uranium and zinc.~~ McFee *et al.* (~~in press~~2010) found age-related variation in growth rates between bottlenose dolphin sexes and some variation (e.g., asymptotic length) between geographic cohorts, which may be the result of contaminant ingestion.

~~Some of the highest~~High concentrations of polychlorinated biphenyls (PCBs) and DDT ~~reported for cetaceans~~ have been found in the blubber of bottlenose dolphins sampled near Charleston (Kuehl and Haebler 1995; Houde *et al.* 2006~~b~~). Blubber concentrations of organohaline pollutants found in male dolphins near Charleston exceeded toxic threshold values and may result in adverse effects on health or reproductive rates (Hansen *et al.* 2004; Schwacke *et al.* 2004).

~~Persistent organic pollutant (POP) accumulation in the blubber of bottlenose dolphins sampled near Charleston indicated Cytochrome P4501A1 expression in the deep blubber layer was strongest, with highest concentrations found in simultaneously pregnant lactating females (Montie *et al.* 2008). During periods of lipid mobilization (e.g., during fasting, starvation, adaptation to warmer water temperatures, lactation or a combinations of these), stored blubber lipids may be redistributed into the circulatory system, enhancing their metabolism, which may interfere with thyroid hormone homeostasis and other essential processes (Montie *et al.* 2008; Vecchione *et al.* 2008).~~

Fair *et al.* (2007) found mean total polybrominated diphenyl ethers (PBDEs) concentrations, associated with sewage sludge and urban runoff, were 5 times greater in the blubber of Charleston dolphins than levels reported for dolphins in the Indian River Lagoon and represent some of the highest measured in marine mammals. ~~Temporal trends in levels of PCBs and PBDEs were evaluated by comparing bottlenose dolphin samples from the 1990's and from the 2000's (Johnson Restrepo *et al.* 2005). An exponential increase in concentrations of these synthetic contaminants over the 10 year period was measured, with an estimated doubling time of 3-4 years for Florida dolphins.~~

Unlike PCBs and organochlorine contaminants, perfluoroalkyl compounds (PFCs) are detected in higher concentrations in the water column than in sediments, thereby potentially being a cause of concern for apex predators such as the bottlenose dolphin (Adams *et al.* 2008). ~~In the Charleston area, highest PFC concentrations were detected in wastewater treatment plant effluents, fish, and dolphin plasma and tissues (Houde *et al.* 2006a).~~ Using blood samples collected from dolphins near Charleston, Adams *et al.* (2008) found dolphins affiliated with areas characterized by high degrees of industrial and urban land use had significantly higher plasma concentrations of perfluoroctane sulfonate (PFOs), perfluorodecanoic acid (PFDA) and perfluoroundeconic acid (PFUnA) than dolphins which spent most of their time in residential areas with lower developed land use, such as wetland marshes. Dolphins residing predominantly in the Ashley, Cooper and Wando Rivers exhibited significantly greater mean

plasma concentration of PFUnA than those associated with Charleston Harbor.

Orogenital papillomas have been reported in bottlenose dolphins from the Charleston area. Bossart *et al.* (2008) found serum iron was slightly lower and serum bicarbonate was significantly higher in Charleston area dolphins with orogenital papillomas compared to healthy dolphins, while dolphins with tumors had multiple abnormalities in serum proteins and immunologic factors. ~~Dolphins with these papillomas, which appear to be sexually transmitted, may have enhanced immunity mediated by secreted antibodies due to increased exposure to other directly transmitted pathogens.~~

Persistent organic pollutant (PCBs, chlordanes, mirex, DDTs, HCB and dieldrin) and polybrominated diphenyl ether concentrations were determined from bottlenose dolphin blubber samples from 14 locations, including the CES, along the U.S. Atlantic and Gulf coasts and Bermuda (Kucklick *et al.* 2011). Dolphins from both rural and urban estuarine and coastal waters were sampled. Dolphins sampled from the CES area had relatively high concentrations of some pollutants, like PBDEs, HCB, dieldrin and chlordanes, and more intermediate concentrations of PCBs, mirex and DDTs, when compared to dolphins sampled from the other 13 locations (Kucklick *et al.* 2011).

There are no estimates of indirect human-caused mortality from pollution or habitat degradation for the CES Stock. Studies of the health of bottlenose dolphins in this area are ongoing (Schwacke, pers. comm.).

STATUS OF STOCK

~~From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the CES Stock is small and relatively few mortalities and serious injuries would exceed PBR, ~~the~~ NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. PBR for the CES Stock is 2.8 and so the zero mortality rate goal, 10% of PBR, is 0.3. The documented annual average human-caused mortality for this stock for 2007 – 2011 ranged~~s~~ between 0 and 0.2. However, the total impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, but has been shown previously to be considerable in this area (Burdett and McFee 2004). Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.~~The status of the CES stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. The impact of crab pots on estuarine bottlenose dolphins is currently unknown, but has been shown to be considerable in the CES (Burdett and McFee 2004). Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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~~December 2009~~

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Northern Georgia/Southern South Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. ~~Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2007), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports.~~ Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002a; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). ~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

Estuarine areas in southern South Carolina and northern Georgia are characterized by extensive tidal marshes, shallow lagoonal estuaries, and riverine input (Savannah, Coosawhatchie, Combahee Rivers). Estuarine circulation patterns are dominated mainly by freshwater inflow and tides in South Carolina and Georgia. This region includes the large population centers of Savannah, Georgia, ~~as well as~~and Hilton Head, South Carolina, which are also~~an~~ areas of significant tourism. ~~The Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) s~~Stock is bounded in the north by the southern border of the Charleston Estuarine System s~~S~~tock at the southern extent of the North Edisto River and extends southwestward to the northern extent of Ossabaw Sound. It includes St. Helena, Port Royal, Calibogue and Wassaw Sounds, as well as the estuarine waters of the rivers and creeks and 1 km of nearshore coastal waters that lie within this area (Figure 1). Photo-ID matches of estuarine animals from the

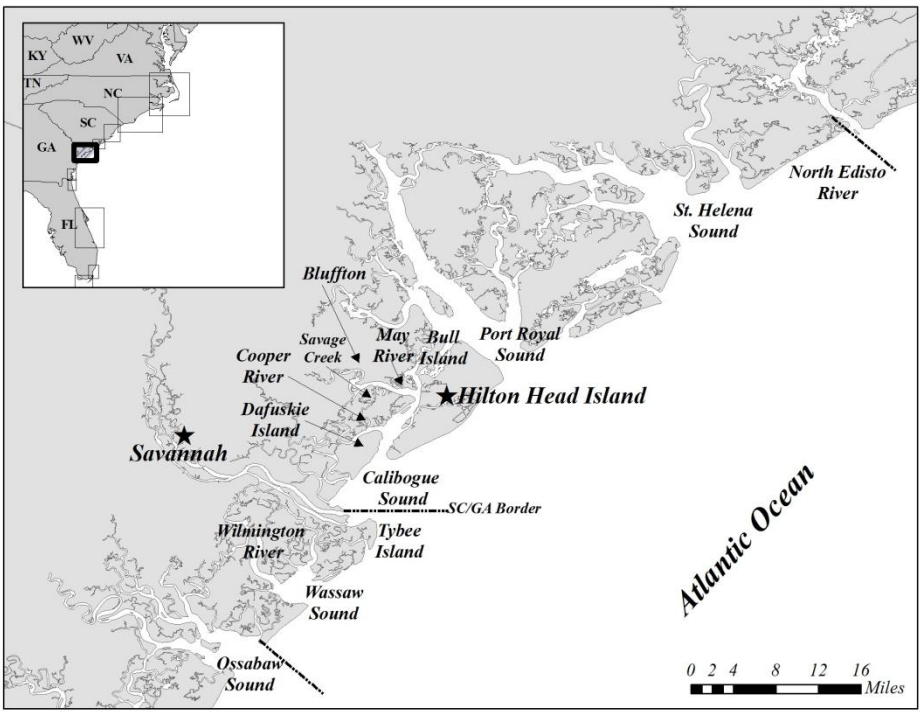

Figure 1. *Geographic extent of the Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) stock. The borders are denoted by dashed lines.*

~~NGSSCES region and the estuarine stocks to the north and south have not been made (Urian *et al.* 1999). The borders are based primarily on results of photo-ID studies conducted by Gubbins (2002a,b,c) in this region, and photo-ID and telemetry research carried out north of this region (Zolman 2002; Speakman *et al.* 2006), and are subject to change upon further study of dolphin residency patterns in estuarine waters of South Carolina and Georgia.~~

From 1994 to 1998, Gubbins (2002a,b,c) surveyed an area around Hilton Head Island bordered on the north by the May River, on the south by the Calibogue Sound, on the west by Savage Creek and on the east by Hilton Head Island. Broad Creek, which bisects Hilton Head Island, and nearshore ocean waters out to 2 km at the mouth of Calibogue Sound were included and were regularly surveyed. Occasional surveys were made around the perimeter of Hilton Head Island.

Gubbins (2002b) categorized each dolphin identified in the Hilton Head area as a year-round resident or a seasonal transient based on overall resighting patterns. Residents were seen in all 4 seasons whereas transients were seen only in 1 or 2 seasons. Resident dolphins were observed from 10 to 116 times, whereas transients were observed less than 9 times (Gubbins 2002b). Sixty-four percent of the dolphins photographically identified were resighted only once between 1994 and 1998. Both resident and transient dolphins occurred in the waters of Calibogue Sound (Gubbins 2002b,c; Gubbins *et al.* 2003), whereas in the tidal creeks and rivers, primarily small, tight groups of resident dolphins were seen, with only an occasional transient dolphin~~ observed in these estuarine areas~~. Two dolphins were resighted between Hilton Head and Jacksonville, which likely represent transients or seasonal residents (Gubbins 2002b). Gubbins *et al.* (2003) reported dolphin abundance in the Hilton Head area was lowest from February to April, with 2 peaks in abundance observed in May and July. Some dolphins were sighted for short periods ~~of time~~ in the summer, indicating transients or seasonal residents may move inshore to this area during the summer months.

The Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) Stock is bounded ~~in~~to the north by the southern border of the Charleston Estuarine System Stock at the southern extent of the North Edisto River and extends southwestward to the northern extent of Ossabaw Sound. It includes St. Helena, Port Royal, Calibogue and Wassaw Sounds, as well as the estuarine waters of the rivers and creeks and 1 km of nearshore coastal waters that lie within this area (Figure 1). Photo-ID matches of estuarine animals from the NGSSCES region and the estuarine stocks to the north and south have not been made (Urian *et al.* 1999). The borders are based primarily on results of photo-ID studies conducted by Gubbins (2002a,b,c) in this region, and photo-ID and telemetry research carried out north of this region (Zolman 2002; Speakman *et al.* 2006), and are subject to change upon further study of dolphin residency patterns in estuarine waters of South Carolina and Georgia.

Dolphins residing within estuaries south of this stock down to the northern boundary of the Southern Georgia Estuarine System (SGES) ~~s~~Stock are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals south of the NGSSCES ~~s~~Stock exhibit affiliation to the NGSSCES ~~s~~Stock, to the SGES ~~s~~Stock to the south, or should be delimited as a separate stock~~are deserving of their own stock status~~. Further research is needed to establish affinities of dolphins in this region. It should be noted, however, that in this intervening region during ~~2003~~ 2007-2011, ~~7~~12 ~~dead~~ stranded dolphins were reported. It could not be determined if there was evidence of human interactions for ~~6~~10 of these stranded animals, and for 1 animal no evidence of human interactions was detected. One animal was disentangled from commercial blue crab pot gear and released alive without serious injury (Maze-Foley and Garrison in prep.).

POPULATION SIZE

The total number of bottlenose dolphins residing within the NGSSCES ~~s~~Stock is unknown. Data collected by Gubbins (2002b) were incorporated into a larger study that used mark-recapture analyses to calculate abundance in 4 estuarine areas along the eastern U.S. coast (Gubbins *et al.* 2003). Sighting records collected only from May through October were used. Based on photo-ID data from 1994 to 1998, 234 individually identified dolphins were observed (Gubbins *et al.* 2003), which included 52 year-round residents and an unspecified number of seasonal residents and transients. Mark-recapture analyses included all the 234 individually identifiable dolphins and the population size for the Hilton Head area was calculated to be 525 dolphins (CV=0.16; Gubbins *et al.* 2003). This ~~is~~was an overestimate of the stock abundance within the study area covered by Gubbins *et al.* (2003) because it included~~s~~ non-resident and seasonally resident dolphins. In addition, the study area did not encompass the entire area occupied by the NGSSCES ~~s~~Stock and therefore this population size cannot be considered a reliable estimate of abundance for this stock. Finally, as recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates

greater than 8 years old are deemed unreliable.

Minimum Population Estimate

The minimum population estimate for this stock of bottlenose dolphins is unknown. Present data are insufficient to calculate a minimum population estimate for the Northern Georgia/Southern South Carolina Estuarine System Stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the NGSSCES ~~s~~Stock is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the NGSSCES ~~s~~Stock of bottlenose dolphins is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the NGSSCES ~~s~~Stock during ~~2003~~ 2007-2011 is unknown. Interactions were documented with crab pot gear and hook and line gear; however, ~~I~~it is not possible to estimate the total number of interactions or mortalities associated with crab pots or hook and line fisheries since there ~~is~~are no systematic observer programs. ~~However, it is clear that this interaction occurs elsewhere within estuarine habitats of the southeastern U.S. coast and does result in mortalities of estuarine bottlenose dolphins (Burdett and McFee 2004).~~

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the NGSSCES stock to interact with the Category II Atlantic blue crab trap/pot fishery and the Category III Atlantic commercial passenger fishing vessel (hook and line) fishery (Appendix III).

Crab Pots

~~Between 2003 and 2007, 4 bottlenose dolphins were reported entangled in crab pot gear in the NGSSCES (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). All 4 dolphins were released alive. One entanglement occurred in August 2005 in the northern reaches of the Wilmington River and 3 crab pot entanglements occurred in 2006 (1 in March in Wassaw Sound, 1 live dolphin was reported in May on Hilton Head Island and 1 entanglement occurred in June on Daufuskie Island).~~ One of the largest commercial fisheries in South Carolina's coastal waters is the Atlantic blue crab (*Callinectes sapidus*) fishery, which operates year round with the predominant fishing occurring from August to November. Burdett and McFee (2004) reviewed bottlenose dolphin strandings in South Carolina from 1992 to 2003 and found that 24% of the 42 entanglements of dolphins were associated with crab pots with an additional 19% of known entanglements deemed as probable interactions with crab pots.

Between 2007 and 2011, 5 bottlenose dolphin strandings were reported entangled in crab pot gear in the NGSSCES (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). Three of the 5 strandings were mortalities. Two of the 5 animals were released alive, 1 of which was considered without serious injury and the other was considered seriously injured (Maze-Foley and Garrison in prep.). For 2 cases the pot gear was identified as commercial blue crab, for 1 case it was identified as illegal, for 1 case it was identified as recreational, and the remaining case was unidentified as to pot gear type.

Hook and Line Fisheries

During 2010 in the NGSSCES area, 1 dolphin was documented with monofilament line wrapped around its flukes and 1 dolphin was documented with an ingested fishing lure. Both of these mortalities were included in the stranding database and are included in the stranding totals presented in Table 1.

Other Mortality

~~From 2003 to 2007, 51 additional bottlenose dolphins were reported stranded within the NGSSCES area (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). It could not be determined if there was evidence of human interactions for 34 of these strandings, and no evidence of human interaction was detected for 15. One dolphin which stranded in September 2006 showed evidence of human interaction, but not fishery interaction (propeller wounds), and an additional dolphin stranded in March 2006 in Tybee Creek at Morgan Cut with signs of net entanglement noted on the dorsal fin. Finally, there have been occasional mortalities of bottlenose dolphins during research activities. Three dolphins were killed in fishery research trammel nets, including a mother/calf pair in March 2004 in Tybee Creek, Georgia, and 1 dolphin in House Creek (Little Tybee Island) in November 2004.~~From 2007 to 2011, 81 bottlenose dolphin strandings were documented within the NGSSCES area (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). There was evidence of human interactions for 14 strandings in total, 10 of which were fisheries interactions including the 5 interactions with crab pot gear and 2 interactions with hook and line gear discussed above. No evidence of human interactions was found for 25 strandings, and for the remaining 42 strandings, it could not be determined if there was evidence of human interactions. In addition to animals included in the stranding database, in 2009 there was an at-sea observation of a dolphin entangled in a crab pot buoy and line, and this animal was considered seriously injured (Maze-Foley and Garrison in prep.).

Stranding data underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

An Unusual Mortality Event (UME) was declared in South Carolina during February-May 2011. Twelve strandings assigned to the NGSSCES Stock were considered to be part of the UME. The cause of this UME is still under investigation.

Table 1. Bottlenose dolphin strandings occurring in the Northern Georgia/Southern South Carolina Estuarine System Stock area during 2007 to 2011, as well as number of strandings for which evidence of human interactions (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interactions. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2007	2008	2009	2010	2011	Total
Northern Georga/Southern South Carolina Estuarine System Stock	Total Stranded	13	11	9	21	27[d]	81
	Human Interaction						
	---Yes	0	2[a]	3[b]	6[c]	3[e]	14
	---No	5	2	1	10	7	25
	---CBD	8	7	5	5	17	42

[a] These HIs were 2 fisheries interactions (FIs), 1 of which was an animal disentangled from commercial blue

crab pot gear and released alive without serious injury.
[b] This HI "Yes" total includes 2 FIs, 1 of which was an animal partially disentangled from recreational pot gear by a member of the public and released alive in unknown condition.
[c] These HIs were 5 FIs and 1 boat collision. Two of the FIs were mortalities resulting from entanglements in crab pot gear. One of the crab trap interactions involved illegal gear. Two FIs involved hook and line gear.
[d] This total includes 12 animals that were part of the 2011 UME event in South Carolina.
[e] These HIs include 1 animal with a bullet found inside (gunshot; likely occurred post-mortem), 1 animal mutilated post-mortem, and 1 mortality resulting from an entanglement in commercial blue crab pot gear.

This stock inhabits areas with significant drainage from urban and agricultural areas and as such is exposed to contaminants in runoff from those sources. There is no estimate of indirect human-caused mortality from pollution or habitat degradation for this stock. However, high tissue concentrations of anthropogenic contaminants are likely to have an effect on reproduction and population health (Hansen *et al.* 2004; Schwacke *et al.* 2004; Reif *et al.* 2008).

Blubber samples were collected from 7 bottlenose dolphins in the Turtle/Brunswick River Estuary (TBRE) and dolphins stranded in Wassaw, Ossabaw and St. Catherine's Sounds (Pulser and Maruya 2008). Total PCB concentrations were 10 times higher in dolphins from the TBRE compared to the stranded animals from the Savannah area. The signature of Aroclor 1268, a PCB used in roofing and caulking compounds, was distinct between the TBRE and Savannah area dolphins and closely resembled those of local prey fish species (Pulser and Maruya 2008).

Gubbins (2002c) speculated that the most serious threat to Hilton Head dolphins is illegal feeding of dolphins.handouts of food, as pProvisioned dolphins spend more time alone and in smaller groups, leaving them vulnerable to shark attacks, more aggressive with each other in an attempt to get free food, and less wary of humans.., leaving them open toThey are also at more risk of injury or death from boat propellers, entanglement in or ingestion of fishing gear, eating spoiled fish, or evenretaliation, such as shooting. There are emerging questions regarding potential linkages between provisioning wild dolphins, dolphin depredation of recreational fishing gear, and associated entanglement and ingestion of gear (Powell and Wells 2011). High boat activity in the Hilton Head area could result in a change in movement patterns, alteration of behavior of both dolphins and their prey, disruption of echolocation and masking of communication, physical damage to ears, collisions with vessels and degradation of habitat quality (Richardson *et al.* 1995; Ketten 1998; Gubbins 2002b; Gubbins *et al.* 2003; Mattson *et al.* 2005). The effect of boat and jet ski activity was investigated by Mattson *et al.* (2005) during the summer of 1998 along Hilton Head Island. Dolphins changed behavior more often when boats were present, and group size was significantly larger in the presence of 1 boat and was largest when multiple boats were present. Jet skis elicited a strong and immediate reaction with dolphins remaining below the surface for long periods of time. Dolphins always changed behavior and direction of movement in the presence of shrimp boats, while ships and ferries elicited little to no obvious response. The long-term impacts of such repeated harassment and disturbance on survival and reproduction remain to be determined. One documented impact from boats was recorded in September 2006 when a dolphin stranded at Bluffton with propeller wounds on its back, as reported above (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008).

STATUS OF STOCK

From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the NGSSCES Stock is currently unknown, but likely small, and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. The documented annual average human-caused mortality for this stock for 2007 – 2011 ranges between 1.0 and 1.4. However, there are several commercial fisheries, including crab trap/pot fisheries, operating within this stock's boundaries and these fisheries have little to no observer coverage. The impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, but has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, the documented mortalities must be considered minimum estimates of total fishery-related

mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this stock.~~The status of the NGSSCES stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. The total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. The impact of crab pots on estuarine bottlenose dolphins is currently unknown, but has been shown to be considerable in the Charleston Estuarine System stock (Burdett and McFee 2004). Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Southern Georgia Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. ~~Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2008), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports.~~ Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.*, 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). ~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the Atlantic coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

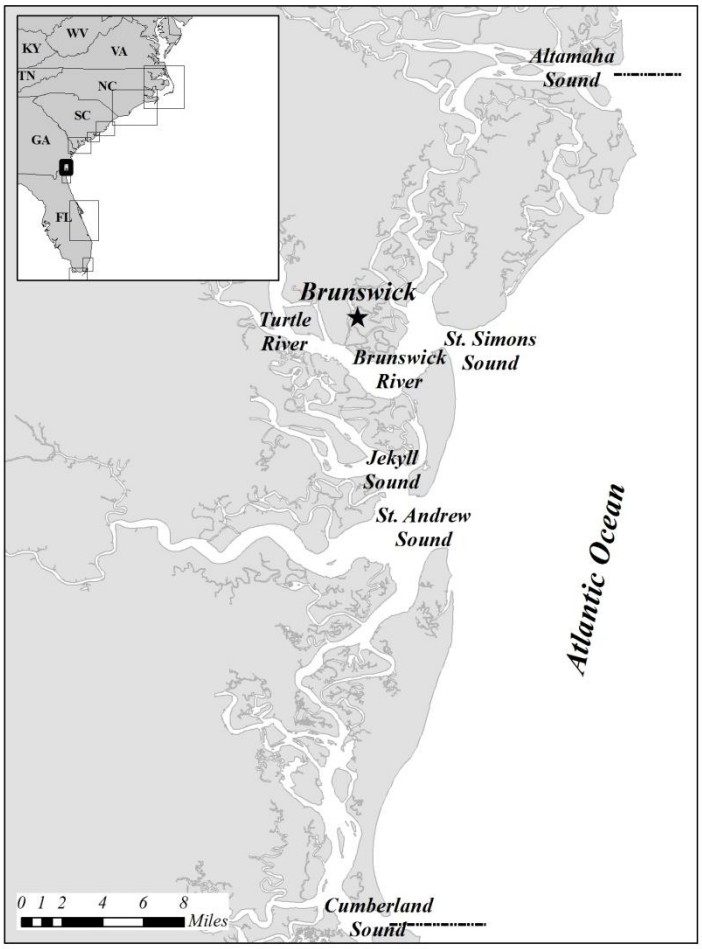

Figure 1. *Geographic extent of the Southern Georgia Estuarine System (SGES) ~~s~~Stock. The borders are denoted by dashed lines.*

Coastal southern Georgia contains an extensive estuarine tidal marsh system, punctuated with several river drainages. There is moderate development throughout the region, along with the larger industrialized area around Brunswick, Georgia~~GA~~, which includes 4 sites on the Environmental Protection Agency's National Priority List (NPL) of hazardous waste sites (EPA 2008).

Balmer *et al.* (2011) conducted photo-ID studies between 2004 and 2009 in two field sites in south-central Georgia, one in the ~~Brunswick/~~Turtle/Brunswick River estuary (TBRE) and the second north of the Altamaha River/Sound including the Sapelo Island National Estuarine Research Reserve and extending north to Sapelo Sound. Photo-ID data revealed strong site fidelity to the two regions and supported Altamaha Sound as an appropriate boundary between the two sites as 85.4% of animals identified did not cross Altamaha Sound (Balmer *et al.* in press). Just over half the animals that did range across Altamaha Sound had low site fidelity and were believed to be members of the South

Carolina/Georgia Coastal Stock.

— Genetic analysis of mitochondrial DNA control region sequences and microsatellite markers of dolphins biopsied in the southern Georgia showed significant genetic differentiation from animals biopsied in northern Georgia and southern South Carolina estuaries as well as from animals biopsied in coastal waters >1 km from shore at the same latitude (NMFS unpublished data). In addition, bottlenose dolphins in the TBRE exhibit contaminant burdens consistent with long-term fidelity to the TBRE (Pulster and Maruya 2008; Balmer *et al.* 2011; Kucklick *et al.* 2011).

Therefore, tThe Southern Georgia Estuarine System sStock (SGES) is bounded in the south by the Georgia/Florida border at the Cumberland River out through Cumberland Sound and in the north by the Altamaha River out through Altamaha Sound inclusive, and encompasses all estuarine waters in between, including but not limited to the Intracoastal Waterway, Hampton River, St. Andrew and Jekyll Sounds and their tributaries, St. Simons Sound and tributaries, and the Turtle/Brunswick River Estuary (TBRE) system (Figure 1). Although the majority of photo-ID survey effort by Balmer *et al.* (in press) was conducted within the estuaries, opportunistic surveys extending along the coast and satellite-linked telemetry of three individuals suggested that animals within the SGES had ranging patterns that extended into the coastal waters of the TBRE. Thus, the nearshore (≤ 1km from shore) coastal waters from Altamaha Sound to Cumberland Sound were included in the SGES Stock boundaries. The southern boundary abuts the northern boundary of the Jacksonville Estuarine System sStock, previously defined based on a photo-ID and genetic data project (Caldwell 2001). The northern borderboundary is defined based on continuity of estuarine habitat, and evidence for significantly lower contaminant levels in dolphins from the Sapleo Island area (Balmer *et al.* 2011) and a genetic discontinuity between dolphins sampled in southern Georgia and those sampled in Charleston, South Carolina (Rosel *et al.* 2009)a significantly high and unique contaminant burden found in dolphins from this area (Pulster and Maruya 2008; Balmer *et al.* 2011; Kucklick *et al.* 2011). . Photo-ID data collected over six years to the north and south of Altamaha Sound, inclusive of the sound, (Balmer *et al.*, in press) also support Altamaha Sound as an appropriate northern boundary. 85.4% of animals identified did not cross Altamaha Sound. Just over half the animals that did range across Altamaha Sound had low site fidelity and were believed to be members of the South Carolina/Georgia Coastal Stock. These boundaries are subject to change upon further study of dolphin residency patterns in estuarine waters of central and northern Georgia.

Genetic analysis of mitochondrial DNA control region sequences and microsatellite markers of dolphins biopsied in the SGES showed significant differentiation from animals biopsied in northern Georgia and southern South Carolina estuaries as well as from animals biopsied in coastal waters >1 km from shore at the same latitude (NMFS unpublished data). In addition, bottlenose dolphins in the TBRE exhibit contaminant burdens consistent with long-term fidelity to the TBRE (Pulster and Maruya 2008).

Dolphins residing in the estuaries north of this stock between Altamaha Sound, Georgia, and Wassaw Sound, Georgia, are not currently covered in any stock assessment report. Based on photo-ID surveys and telemetry, Balmer *et al.* (in press) identified dolphins with high site-fidelity to the estuarine waters from Altamaha Sound north to and including Sapelo Sound. These animals did not have extended ranging patterns outside of this region, suggesting that they may represent a separate stock and should not be included in the SGES or Northern Georgia/Southern South Carolina Estuarine System (NGSSCES) Stocks. Future research focusing on the waters north of Sapelo Sound to the southern boundary of the NGSSCES (Ossabaw Sound) is necessary to identify the ranging patterns of dolphins in this region and determine appropriate stock delineations.There are insufficient data to determine whether animals in this region exhibit affiliation to the SGES stock or to the stock to the north, the Northern Georgia/Southern South Carolina Estuarine System stock or should be delineated as their own stock. Further research is needed to establish affinities of dolphins in this region. It should be noted, however, that in this intervening region during 2003 2007-2011, 712 dead stranded dolphins were reported. but iIt could not be determined if there was evidence of human interactions for 610 of these stranded animals, and for 1 animal no evidence of human interactions was detected. One animal was disentangled from commercial crab pot gear and released alive without serious injury (Maze-Foley and Garrison in prep.).

POPULATION SIZE

The total number of bottlenose dolphins residing within the Southern Georgia Estuarine System stock is unknown. The Georgia Dolphin Project conducted quarterly boat-based surveys from 1992 to 2003 to photograph and count dolphins, but no abundance estimate has been published from this work. Gubbins *et al.* (2003), using photo-ID methods to identify individual dolphins, provided an estimate of 525 dolphins (CI: 399, 728) for a portion of the area covered by the SGES stock. However, these data were collected during May – October 1997 and hence

~~are considered expired.~~ During 2008-2009, seasonal, mark-recapture, photo-ID surveys were conducted to estimate abundance in a portion of the SGES including St. Simons Sound north to and inclusive of Altamaha Sound. Estimates from winter were chosen as the best representation of the portion of resident estuarine stock in the area surveyed, and a random emigration model was chosen as the best fit based on the lowest Akaike's Information Criterion value. The estimated average abundance estimate, based on winter 2008 and winter 2009 surveys, was 194 (CV=0.05; Balmer *et al.*, in press). It is important to note this estimate covered less than half of the entire range of the SGES Stock, and therefore, the abundance estimate is negatively biased. ~~In 2008, new efforts to estimate abundance in a portion of the SGES from St. Simons Sound to the Altamaha River were initiated (Balmer, pers. comm.). Mark recapture, photo-ID surveys are planned for every season for 2 years and were started in February 2008 (Balmer, pers. comm.). This research should yield an abundance estimate for a large portion of this stock's range.~~

Minimum Population Estimate

~~stock of bottlenose dolphins.~~The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). Though negatively biased, the best estimate for the SGES Stock is 194 (CV=0.05). The resulting minimum population estimate is 185.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the SGES ~~s~~Stock of bottlenose dolphins is ~~unknown~~185. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for this stock of bottlenose dolphins is 1.9~~unknown~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury ~~of~~within the SGES Stock of bottlenose dolphins ~~stock~~ during ~~2003~~ 2007-2011 is unknown. No interactions with crab pot gear were documented; however, it is not possible to estimate the total number of interactions or mortalities associated with crab pots since there is no systematic observer program.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the SGES Stock to interact with the Category II Atlantic blue crab trap/pot fishery (Appendix III).

Crab Pots

During 2007-2011 there were no documented interactions with crab pots in the SGES area. However, 3 earlier

interactions involving live animals observed entangled in crab pot gear were documented during 2001, 2004 and 2005. Between 2003 and 2007, there were 2 documented reports of fishery related interactions for this stock: 1 attributed to commercial blue crab pot gear; the second involved gear consistent with the crab pot fishery (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). One of the 2 animals was disentangled and released alive (condition unknown) and the second was seen towing ~2-3 m of white line with a buoy on the end. Disentanglement efforts failed. In addition, there was a documented crab pot entanglement in 2001 in which the animal was released alive. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, bottlenose dolphin interactions with and entanglement in crab pot gear are well documented and mortalities have occurred in estuarine areas similar to the estuarine waters of southern Georgia (Burdett and McFee 2004). Thus, the potential for crab pot fishery gear to cause mortalities of bottlenose dolphins in the SGES should not be discounted.

Other Mortality

From 2003 to 2007, 15 additional bottlenose dolphins were reported stranded within the SGES (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008).From 2007 to 2011, 24 bottlenose dolphins were reported stranded within the SGES (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). It was not possible to make any determination of possible human interaction for 1423 of these strandings. For the remaining dolphin, no evidence of human interactions was detected. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

A portion of the stock's range is highly industrialized, and the Environmental Protection Agency has included 4 sites within the Brunswick area on its National Priority List (NPL) of hazardous waste sites (EPA 2008). Specifically, the LCP Chemicals Site contaminated soils, groundwater and adjacent marsh with mercury and polychlorinated biphenyls (PCBs). Mean total polychlorinated biphenyl (PCB) concentrations from dolphins biopsied in the TBRETurtle/Brunswick River Estuary (Pulster and Maruya 2008; Sanger *et al.* 2008) were significantly higher than dolphins sampled in other areas of the world including other inshore estuarine waters along the Southeast coast of the United States, including the Gulf of Mexico (Schwacke *et al.* 2002; Hansen *et al.* 2004; Litz 2007; Balmer *et al.* 2011; Kucklick *et al.* 2011). PCB congeners measured in tissues of dolphins biopsied in the TBRE system were enriched in highly chlorinated homologs consistent with Aroclor 1268 (Pulster and Maruya 2008; Sanger *et al.* 2008,Balmer *et al.* 2011; Kucklick *et al.* 2011). The TBRE area is known to be contaminated with this specific PCB mixture in soil and sediments, and the transport of these contaminants into the food web through invertebrate and vertebrate fauna has been documented (Kannan *et al.* 1997; Kannan *et al.* 1998; Maruya and Lee 1998).

Studies have suggested an increased risk of detrimental effects on reproduction and endocrine and immune system function for marine mammals in relation to tissue concentrations of PCBs (De Swart *et al.* 1996; Kannan *et al.* 2000; Schwacke *et al.* 2002). PCB-related health effects on bottlenose dolphins along the Georgia coast were examined through a capture-release health assessment conducted during 2009 in the TBRE and in waters near Sapelo Island (Schwacke *et al.* 2012). Results from hematology and serum chemistry indicated abnormalities, most notably that 26% of sampled dolphins were anemic. Also, dolphins showed low levels of thryoid hormone, and thyroid hormones negatively correlated with PCB concentration measured in blubber. In addition, a reduction in innate and acquired immune response was found. T-lymphocyte proliferation and indices of innate immunity decreased with PCB concentration measured in blubber, indicating increased vulnerability to infectious disease. Overall, the results plainly showed that bottlenose dolphins are susceptible to PCB-related health effects (Schwacke *et al.* 2012).

Thus, the high levels of PCBs recorded in dolphins from this stock, along with demonstrated PCB-related health effects, raise concern for the long-term health and viability of the stock. However, there are no estimates of indirect human-caused mortality from pollution or habitat degradation. Studies of the distribution and health of bottlenose dolphins in this area are ongoing (Sanger *et al.* 2008; Schwacke, pers. comm.).

STATUS OF STOCK

From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the

~~western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the SGES Stock is small and relatively few mortalities and serious injuries would exceed PBR, ~~the~~ NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. PBR for this stock is 1.9 and so the zero mortality rate goal, 10% of PBR, is 0.2. There have been no documented human-caused mortalities to this stock during 2007 – 2011. Entanglements in both commercial and recreational crab pot fisheries have been documented in prior years, and while the impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, it has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, documented mortalities must be considered minimum estimates of total fishery-related mortality. Detrimental impacts of high pollutant burdens may be a significant issue for this stock due to the high mean total polychlorinated biphenyl (PCB) concentrations found in the blubber of animals in this region. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.~~The status of the SGES stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Entanglements in both commercial and recreational crab pot fisheries are documented, and detrimental impacts of high pollutant burdens may be a significant issue for this stock due to the high mean total polychlorinated biphenyl (PCB) concentrations found in the blubber of animals in this region. Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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April 2013
~~December 2009~~

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Jacksonville Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. ~~Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2009), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports.~~ Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data).~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

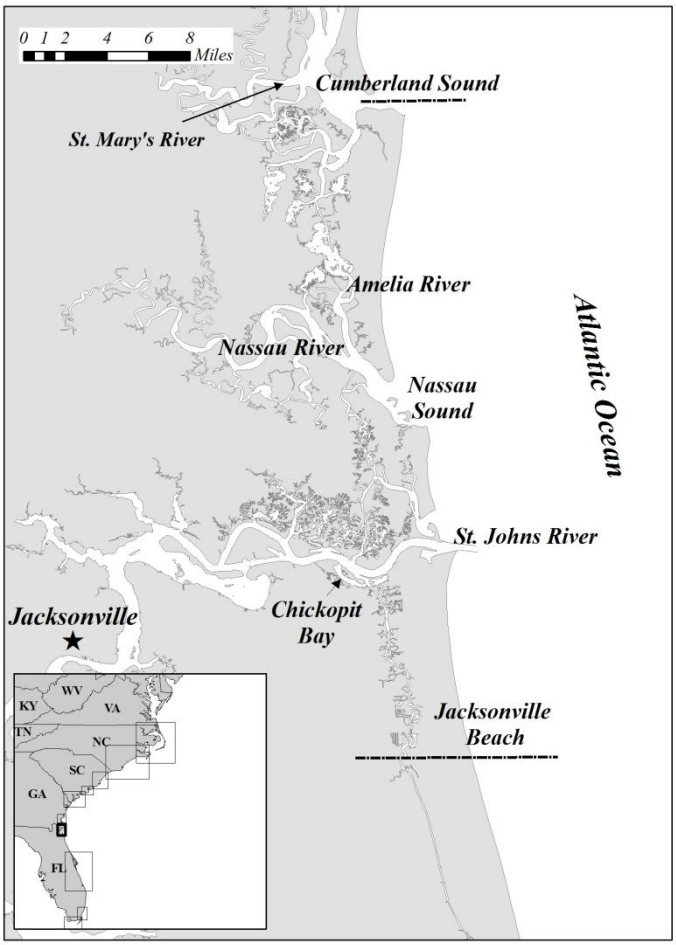

Figure 1. *Geographic extent of the Jacksonville Estuarine System (JES) stock. The borders are denoted by dashed lines.*

~~The Jacksonville Estuarine System (JES) s~~Stock is bounded in the north by the ~~Florida/Georgia border at Cumberland Sound, abutting the southern border of the Southern Georgia Estuarine System s~~Stock, and extends south to Jacksonville Beach, Florida. ~~This encompasses an area defined during a photo-ID field study of bottlenose dolphin residency patterns in the area (Caldwell 2001).~~ The estuarine habitat around Jacksonville, Florida, is ~~comprised~~ composed of several large brackish rivers, including St. Mary's, Amelia, Nassau, Fort George and St. John's River (Figure 1). The St. John's River is a deep, swift moving river with heavy boat and shipping activity (Caldwell 2001). The remainder of the area is made up of tidal marshes and riverine systems averaging 2m in depth over sand, mud or oyster beds, and is bisected by the Intracoastal Waterway. ~~The borders are subject to change upon further study of dolphin residency patterns in estuarine waters of southern Georgia and Florida.~~

~~Stock has been defined as a separate estuarine stock primarily by the results of photo-ID and genetic studies.~~

Caldwell (2001) investigated the social structure of bottlenose dolphins inhabiting the estuarine waters between the St. Mary's River and Jacksonville Beach, Florida, using photo-ID and behavioral data obtained from December 1994 through December 1997. Three behaviorally different communities were identified during this study, namely the estuarine waters north of St. John's River (termed the Northern area), the estuarine waters south of St. John's River (the Southern area) and the coastal area, all of which differed in density, habitat fidelity and social affiliation patterns. Caldwell (2001) found that dolphins inhabiting the Northern area were the most isolated, with 96% of the groups observed containing dolphins that had been photographically identified only in this area, demonstrating strong year-round site fidelity. Cluster analyses suggested that dolphins using the Northern area did not socialize with those using the Southern area. In the Southern area, 78% of the groups were photographed only in this region (Caldwell 2001). However, these dolphins migrated into and out of the Jacksonville area each year, returning to the area during 3 consecutive summers, suggesting the Southern area dolphins may show summer site fidelity as opposed to the year-round fidelity demonstrated in the Northern area. Caldwell (2001) found that dolphins found in the coastal areas were highly mobile, had fluid social affiliations, were not sighted more than 8 times over the entire study and showed no long-term (>4 months) site fidelity. Three of these dolphins were also sighted off South Carolina, behind shrimp boats. These coastal dolphins are thus considered to be members of the coastal morphotype stocks.

Caldwell (2001) also examined genetic differentiation among the Northern, Southern and coastal areas of the study site using mitochondrial DNA sequences and microsatellite data. Both mitochondrial DNA haplotype and microsatellite allele frequencies differed significantly between the Northern and Southern sampling areas. Differentiation between the Southern sampling area and the coast was lower, but still significant. These genetic data are in line with the behavioral analyses. However, sample sizes were small for these estuarine regions (n≤25) and genetic analyses did not account for the high number of closely related individuals within the dataset. Further analyses are necessary to confirm the results.

The JES sStock demonstrated oscillating abundance year round (Gubbins *et al.* 2003) with low numbers reported in January and December. There was a positive correlation between dolphin abundance and water temperature, with peak numbers seen when water temperatures rose above 16°C.

Caldwell (2001) examined genetic differentiation among the Northern, Southern and coastal areas of the study site using mitochondrial DNA sequences and microsatellite data. Both mitochondrial DNA haplotype and microsatellite allele frequencies differed significantly between the Northern and Southern sampling areas. Differentiation between the Southern sampling area and the coast was lower, but still significant. These genetic data are in line with the behavioral analyses. However, sample sizes were small for these estuarine regions (n≤25) and genetic analyses did not account for the high number of closely related individuals within the dataset. Further analyses are necessary to confirm the results.

Despite the strong fidelity to the Northern and Southern areas, dolphins were photographed outside their preferred areas, supporting the proposal to include both these areas within the boundaries of the JES sStock. Future analyses may provide additional information on the importance of the Southern area to the resident stock, and thus the inclusion of both areas in this stock boundary may be modified with additional data or further analyses.

Gubbins *et al.* (2003) identified oscillating abundance year round for dolphins within the estuarine waters of this area, with low numbers reported in January and December. There was a positive correlation between dolphin abundance and water temperature, with peak numbers seen when water temperatures rose above 16°C.

The Jacksonville Estuarine System (JES) Stock has been defined as a separate estuarine stock primarily by the results of these photo-ID and genetic studies. It is bounded in the north by the Florida/Georgia border at Cumberland Sound, abutting the southern border of the Southern Georgia Estuarine System Stock, and extends south to Jacksonville Beach, Florida. -Despite the strong fidelity to the Northern and Southern areas observed by Caldwell (2001), some dolphins were photographed outside their preferred areas, supporting the proposal to include both these areas within the boundaries of the JES Stock. Future analyses may provide additional information on the importance of the Southern area to the resident stock, and thus the inclusion of both areas in this stock boundary may be modified with additional data or further analyses.

Dolphins residing within estuaries south of this stock down to the northern boundary of the Indian River Lagoon Estuarine System sStock are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals south of the JES sStock exhibit affiliation to the JES sStock, the IRLES sStock to the south or are simply transient animals associated with coastal stocks. Further research is needed to establish affinities of dolphins in this region. It should be noted that during 2007-2011, there were 36 2003-2007, there were 16

stranded bottlenose dolphins in this region in estuarine waters. Evidence of human interactions was detected for 11~~4~~ of these stranded dolphins, 3~~2~~ of which involved fishery interactions with hook and line gear, including ~~a crab pot entanglement~~an animal disentangled from recreational gear and released alive without serious injury during 2011 (Maze-Foley and Garrison in prep.). ~~The other 2~~Seven of the 11 human interactions involved boat collisions, and the remaining human interaction was a stranding with signs of mutilation (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012~~10 November 2008~~). In addition to animals included in the stranding database, in 2010 there was an at-sea observation of a dolphin entangled in hook and line gear, and during 2011, there was an at-sea observation of a dolphin entangled in crab pot gear, which the animal later shed on its own. Both dolphins were considered not seriously injured (Maze-Foley and Garrison in prep.).

POPULATION SIZE

The total number of bottlenose dolphins residing within the JES ~~s~~Stock is unknown because previous estimates are greater than 8 years old. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates greater than 8 years old are deemed unreliable. Data collected by Caldwell (2001) were incorporated into a larger study that used mark-recapture analyses to calculate abundance in 4 estuarine areas along the eastern U.S. coast (Gubbins *et al.* 2003). Sighting records collected only from May through October were used, as this limited time period was determined to reduce the possibility of violating the mark-recapture model's assumption of geographic closure and mark retention. Based on photo-ID data from 1994 to 1997, 334 individually identified dolphins were observed (Gubbins *et al.* 2003), which included an unspecified number of seasonal residents and transients. Mark-recapture analyses included all the 334 individually identifiable dolphins, and the population size for the JES ~~s~~Stock was calculated to be 412 residents (CV=0.06; Gubbins *et al.* 2003). This ~~is~~was an overestimate of the stock abundance in the area covered by the study because it included~~s~~ non-resident and seasonally resident dolphins. Caldwell (2001) indicated that 122 dolphins were resighted at least 10 times in the JES, with 33 individuals observed primarily in the Northern area, and 89 individuals reported to use the Southern area.

Minimum Population Estimate

~~The minimum population estimate for this stock of bottlenose dolphins is unknown.~~Present data are insufficient to calculate a minimum population estimate for the JES Stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the JES ~~s~~Stock is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR is unknown for this stock.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury within the JES ~~s~~Stock during ~~2003~~ 2007-2011 is unknown. Interactions were documented with crab pot gear and hook and line gear; however, ~~I~~it is not possible to estimate the total number of interactions or mortalities associated with crab pots or hook and line fisheries since there ~~is~~are no systematic observer programs. ~~However, this interaction is a common occurrence elsewhere within~~

~~estuarine habitats of the southeastern U.S. coast and does result in mortalities of estuarine bottlenose dolphins (Burdett and McFee 2004).~~

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the JES Stock to interact with the Category II Atlantic blue crab trap/pot and Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot fisheries (Appendix III). The JES Stock may also interact with the Category III Atlantic commercial passenger fishing vessel (hook and line) fishery.

Crab Pots

~~Between 2003 and 2007, 1 bottlenose dolphin carcass recovered within the JES area displayed evidence of possible interaction with a trap/pot fishery (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008).~~Between 2007 and 2011, 3 strandings within the JES area displayed evidence of interaction with a trap/pot fishery (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2013). Two carcasses were entangled in crab trap gear (identified as commercial blue crab trap gear in one case and unidentified trap/pot gear in the second), and one live animal was observed entangled in commercial crab trap line and buoys. The live animal was observed to shed the gear on its own and was considered not seriously injured (Maze-Foley and Garrison in prep.). In addition to animals included in the stranding database, in 2008 there was an at-sea observation in the JES area of a dolphin entangled in gear consistent with crab trap gear, and this dolphin was considered seriously injured (Maze-Foley and Garrison in prep.).

Hook and Line Fisheries

During 2007-2011, 2 dolphins within the JES area stranded dead with hook and line gear attached. Both animals were recovered with monofilament fishing line. These mortalities were included in the stranding database and are included in the stranding totals presented in Table 1.

Other Mortality

~~From 2003 to 2007, 16 additional stranded bottlenose dolphins were recovered within the JES area (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). For 3 dolphins, no evidence of human interactions was detected. It was not possible to make a determination of human interaction for the remaining 12 strandings.~~ During 2007-2011, 39 strandings were documented within the JES area, including 8 strandings with evidence of a human interaction. The 3 crab trap interactions and 2 hook and line gear interactions noted above account for 5 of the human interactions (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2013). One additional fishery interaction was documented (unknown type), as well as evidence of 1 boat collision (well-healed propeller scars). Also, 1 live animal was observed entangled in and trailing unknown material/gear, and this animal was considered seriously injured (–Maze-Foley and Garrison in prep.). For 7 strandings, no evidence of human interactions was found, and for 24 strandings, it could not be determined if there was evidence of human interactions. Stranding data underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

An Unusual Mortality Event (UME) was declared for the St. Johns River area during May-September 2010, including 14 strandings assigned to the JES Stock and 4 strandings within estuaries to the south not currently

included in any stock assessment report. The cause of this UME is still under investigation.

This stock inhabits areas with significant drainage from industrial and urban sources, and as such is exposed to contaminants in runoff from these. No contaminant analyses have yet been conducted in this area, so there is no estimate of indirect human-caused mortality from pollution or habitat degradation for this stock. In other estuarine areas where such analyses have been conducted, exposure to anthropogenic contaminants have been found to likely have an effect (Hansen *et al.* 2004; Schwacke *et al.* 2004; Reif *et al.* 2008).

Table 1. Bottlenose dolphin strandings occurring in the Jacksonville Estuarine System, South Carolina, from 2007 to 2011, as well as number of strandings for which evidence of human interactions (HI) was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interactions. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 13 September 2012). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	Category	2007	2008	2009	2010	2011	Total
Jacksonville Estuarine System	Total Stranded	4	5	7	16[c]	7	39
	Human Interaction						
	---Yes	0	2[a]	3[b]	1[d]	2[e]	8
	---No	2	0	0	4	1	7
	---CBD	2	3	4	11	4	24

[a] These HIs include 1 fishery interaction (FI; hook and line gear) and 1 boat collision (well-healed propeller scars)
[b] These HIs include 3 FIs, 1 of which was an animal (mortality) entangled in crab pot gear.
[c] 14 of these strandings were part of the St. Johns River UME during May-September 2010.
[d] This HI was an animal entangled in crab pot gear; the animal shed the gear on its own and was not considered to be seriously injured.
[e] These HIs include 1 mortality from an entanglement in commercial blue crab pot gear. Also included is 1 animal observed entangled in and trailing unknown material/gear and considered to be seriously injured.

STATUS OF STOCK

~~From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the JES Stock is currently unknown, but likely small, and relatively few mortalities and serious injuries would exceed PBR, ~~the~~ NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. The documented annual average human-caused mortality for this stock for 2007 – 2011 is 0.8. However, there are several commercial fisheries, including crab trap/pot fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. The impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, but has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, the documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

~~The status of the JES stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and~~

~~approaching zero mortality and serious injury rate. The impact of crab pots on estuarine bottlenose dolphins is currently unknown, but has been shown to be considerable in the Charleston Estuarine System stock (Burdett and McFee 2004). Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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Indian River Lagoon Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of bays, sounds and estuaries. ~~Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2007), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports.~~ Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas of the southeastern United States (e.g., Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (e.g., Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data).~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between biopsies collected from bottlenose dolphins along the coast and those collected within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been reported for the west coast of Florida (Sellas *et al.* 2005).

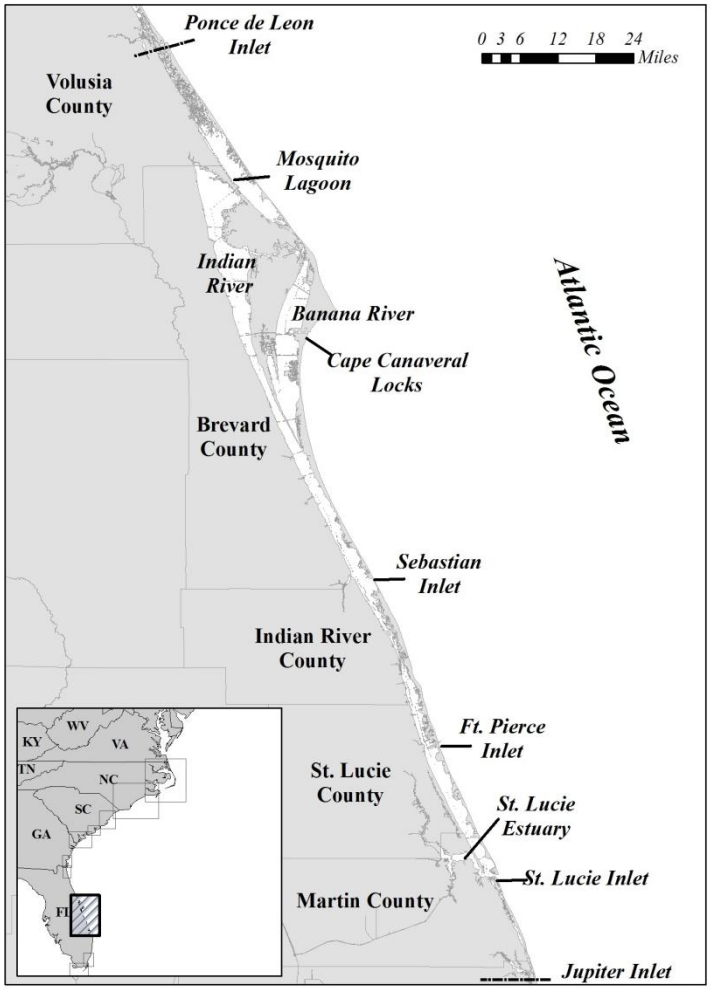

Figure 1. *Geographic extent of the Indian River Lagoon Estuarine System (IRLES) ~~s~~Stock. Dashed lines denote the boundaries.*

~~The Indian River Lagoon Estuarine System (IRLES) stock on the Atlantic coast of Florida extends from Ponce de Leon Inlet in the north to Jupiter Inlet in the south and encompasses all estuarine waters in between, including but not limited to the Intracoastal Waterway, Mosquito Lagoon, Indian River, Banana River and the St. Lucie Estuary. Five inlets and the Cape Canaveral Locks connect the IRLES to the Atlantic Ocean. This definition of the IRLES has been used by a number of researchers (e.g., Kent *et al.* 2008) and is the most expansive definition. Some researchers truncate the southern border at the St. Lucie Inlet.~~

Multiple studies utilizing varying methods such as freeze-branding, photo-ID and radio telemetry support the

designation of bottlenose dolphins in the ~~IRLES~~Indian River Lagoon (IRL) as a distinct stock. Odell and Asper (1990) reported that none of the 133 freeze-branded dolphins from the IRL~~ES~~ were observed outside of the system during their 4-year monitoring period from 1979 to 1982 and suggested that there may be an additional discrete group of dolphins in the southern end of the system. A stranded dolphin from the IRL~~ES~~ that was rehabilitated, freeze-branded and released into the IRL~~ES~~ was recaptured 14 years later in the IRL~~ES~~ during a health assessment project (Mazzoil *et al.* 2008b). Photo-ID studies have provided evidence that some dolphins in the IRL~~ES~~ exhibit both short-term and long-term site fidelity (Mazzoil *et al.* 2005; Mazzoil *et al.* 2008a). During a 5-year study (1996-2001) in the IRL~~ES~~, 67 individual dolphins were sighted 8 or more times, which included 11 dolphins freeze-branded from the Odell and Asper (1990) study that were sighted at least once (Mazzoil *et al.* 2005). In addition, Mazzoil *et al.* (2008a) suggested that at least 3 different dolphin communities exist within the IRL~~ES~~ based on analyses of photo-ID data. Radio-tracking of 2 rehabilitated dolphins stranded in the IRL~~ES~~ indicated that neither dolphin left the IRL~~ES~~ from the time of release until their deaths in 100 days and 7days, respectively (Mazzoil *et al.* 2008b). A photo-ID study conducted from 2006-2008 provided evidence for spatial separation and minimal degree of movement between dolphins in the IRL and those occurring in the nearshore coastal waters of the Atlantic Ocean between Sebastian and St. Lucie Inlets (Mazzoil *et al.* 2008a). However, results from aerial surveys to estimate abundance during 2002-2004 (Durden *et al.* 2011, described under "Population Size" below) seem to contradict an exclusively resident population, and rather suggest movements of IRL dolphins between adjacent estuarine and/or coastal waters. There is still a need to better understand movement patterns between the IRL and adjacent coastal and estuarine waters. The boundaries of this stock are subject to change upon further study.

The Indian River Lagoon Estuarine System (IRLES) Stock on the Atlantic coast of Florida extends from Ponce de Leon Inlet in the north to Jupiter Inlet in the south and encompasses all estuarine waters in between (Figure 1), including but not limited to the Intracoastal Waterway, Mosquito Lagoon, Indian River, Banana River and the St. Lucie Estuary. Five inlets and the Cape Canaveral Locks connect the IRLES to the Atlantic Ocean. This definition of the IRLES has been used by a number of researchers (e.g., Kent *et al.* 2008) and is the most expansive definition. Some researchers truncate the southern border at the St. Lucie Inlet.

Dolphins residing within estuaries north and south of this stock are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals south of the IRLES exhibit affiliation to the Biscayne Bay ~~s~~Stock or are simply transient animals associated with coastal stocks. Similarly, there are insufficient data to determine whether animals in estuarine waters north of the IRLES exhibit affiliation to the IRLES ~~s~~Stock or to the Jacksonville Estuarine System ~~s~~Stock to the north or are simply transients. There is relatively limited estuarine habitat along the coastline south of the IRLES but some potentially suitable habitat north of the IRLES. Further research is needed to establish affinities of dolphins in these regions. It should be noted that during ~~2003~~ 2007-2011, there were ~~16~~36 stranded bottlenose dolphins in the region north of the IRLES in enclosed waters. ~~Evidence of human interaction was detected for 4 of these strandings, including 2 fishery interactions with crab pots (1 of these was a live animal that was disentangled) and 2 boat strikes (1 fresh prop marks and 1 healed prop marks).~~ Evidence of human interactions was detected for 11 of these stranded dolphins, 3 of which involved fishery interactions with hook and line gear, including an animal disentangled from recreational gear and released alive without serious injury (Maze-Foley and Garrison in prep.). Seven of the 11 human interactions involved boat collisions, and the remaining human interaction was a stranding with signs of mutilation. There ~~were 3~~was 1 estuarine stranding~~s~~ south of the IRLES. ~~One of these had signs human of interaction from a boat strike and another was identified as belonging to the offshore morphotype~~ It could not be determined if there was evidence of human interactions for this stranded animal (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). In addition to animals included in the stranding database, in estuarine waters north of the IRLES in 2010 there was an at-sea observation of a dolphin entangled in hook and line gear, and during 2011, there was an at-sea observation of a dolphin entangled in crab pot gear, which the animal later shed on its own. Both dolphins were considered not seriously injured (Maze-Foley and Garrison in prep.).

POPULATION SIZE

Population size estimates for this stock are greater than 8 years old and therefore the current population size for the stock is considered unknown (Wade and Angliss 1997). Abundance estimates ranging from 206 to 816 dolphins (~~Table 1~~Leatherwood 1979; Thompson 1981; Leatherwood 1982; Burn *et al.* 1987; Mullin *et al.* 1990) were made in the 1970's and 1980's in response to bottlenose dolphin live-capture fisheries where 68 dolphins were permanently removed between 1973 and 1988 for ~~captive~~ display in marine parks and use by the military (Scott 1990). No

dolphins have been removed from the IRLES since 1989. Abundances based on aerial and small boat-based strip- or line-transect surveys were estimated to establish capture quotas or to assess the impact of the removals (Scott 1990). Scott (1990) suggested that a large number of bottlenose dolphins moved into the IRLES during the summer from the adjacent Atlantic Ocean. However, preliminary analyses of extensive photo-ID data collected throughout the IRLES and the adjacent Atlantic from 2002 to 2008 do not support this hypothesis and indicate very few bottlenose dolphins move between the IRLES and the Atlantic Ocean (Mazzoil *et al.* 2011~~, pers. comm.~~). During photo-ID studies conducted in the IRLES for 3 years from 2002 to 2005, 615 bottlenose dolphins with distinct dorsal fins were identified (Mazzoil *et al.* 2008a). ~~While mortality of some of these 615 identified dolphins certainly occurred during the 3 years, there were also dolphins with indistinct dorsal fins that were not included in the count.~~ This number of dolphins is ~~also~~ comparable to the larger abundances previously estimated (506-816 dolphins) which were based on small boat surveys (Mullin *et al.* 1990) and a mark-recapture study (Burn *et al.* 1987) and were probably less negatively biased compared to the aerial surveys. Seasonal aerial surveys were conducted from summer 2002 through spring 2004 (Durden *et al.* 2011). Abundance estimates were lowest in summer and highest in winter, ranging from 362 (CV=0.29) for summer 2003 to 1316 (CV=0.24) for winter 2002-2003 with an overall mean abundance of 662 (CV=0.09). These results also do not support Scott (1990) regarding dolphin movements into the IRLES during summer. The pattern of larger winter estimates occurred in both years of the Durden *et al.* (2011) study and was pronounced in two areas, Mosquito Lagoon and southern Indian River. ~~Analyses of recently collected aerial survey data and capture-recapture analyses from the photo-ID studies are currently underway that should yield updated abundance estimates (Noke-Durden, pers. comm.; Mazzoil, pers. comm.).~~

~~Table 1. Abundance estimates for the Indian River Lagoon System.~~

~~Study~~	~~Type~~	~~Year & Month~~	~~N_{best}~~	~~CV~~
~~Leatherwood (1979)~~	~~Aerial - transect~~	~~1977 August~~	~~438~~	~~0.15~~
~~Thompson (1981)~~	~~Aerial - transect~~	~~1980 May~~	~~206~~	~~0.42~~
	~~Aerial - transect~~	~~1980 August~~	~~435~~	~~0.19~~
	~~Aerial - transect~~	~~1980 November~~	~~202~~	~~0.26~~
~~Leatherwood (1982)~~	~~Aerial - transect~~	~~1979 November~~	~~222~~	~~0.08~~
	~~Aerial - transect~~	~~1980 January~~	~~214~~	~~0.10~~
~~Burn *et al.* (1987)~~	~~Mark - recapture~~	~~1982~~	~~553~~	~~~ 0.05~~
~~Mullin *et al.* (1990)~~	~~Boat - transect~~	~~1985 July~~	~~816~~	~~0.15~~
	~~Boat - transect~~	~~1986 March~~	~~506~~	~~0.21~~
~~Griffin and Patton (1990)~~	~~Aerial - transect~~	~~1987-1990~~	~~143[a]~~	~~0.09~~
~~[a] Average of seasonal surveys~~				

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the IRLES ~~s~~Stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock. It would be difficult to use historical abundance estimates for meaningful trend analysis due to differences in the survey and analytical methods, and specific areas surveyed.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the IRLES ~~s~~Stock of bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the IRLES ~~s~~Stock of bottlenose dolphins is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for this stock during 2007-2011~~2003-2007~~ is unknown. Interactions were documented with crab pot gear and hook and line gear; however, it is not possible to estimate the total number of interactions or mortalities associated with crab pots or hook and line fisheries since there are no systematic observer programs.

A bottlenose dolphin live-capture fishery operating between 1973 and 1988 in the IRLES permanently removed 68 bottlenose dolphins for ~~captive~~ display in marine parks and for use by the military (Scott 1990). No dolphins have been removed from the IRLES since 1989.

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the IRLES Stock to interact with the Category II Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot and Atlantic blue crab trap/pot fisheries. The IRLES Stock may also interact with the Category III Atlantic commercial passenger fishing vessel (hook and line) fishery (Appendix III).

Crab Pots

Interactions between bottlenose dolphins and the blue crab fishery in the IRLES have been documented. Noke and Odell (2002) observed behaviors that included dolphins closely approaching crab boats, begging, feeding on discarded bait and crab pot tipping to remove bait from the pot. Of the dolphins sighted during this 1-year study, 16.6% interacted with crab boats and these interactions peaked during summer months. Also during the 1-year study, in March 1998 a dolphin was found dead, entangled in float lines with 3 crab pots attached (Noke and Odell 2002).

~~Table 2. Bottlenose dolphin strandings by county within the Indian River Lagoon System from 2003 to 2007, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (accessed 10 November 2008). Please note human interaction does not necessarily mean the interaction caused the animal's death.~~

~~COUNTY~~		~~2003~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	~~TOTAL~~
~~Volusia~~							
	~~Total Stranded~~	~~3~~	~~0~~	~~6~~	~~2~~	~~5[a]~~	~~16~~
	~~Human Interaction~~						
	~~--Fishery Interaction~~	~~1~~	~~0~~	~~1~~	~~0~~	~~0~~	~~2~~
	~~--Other~~	~~0~~	~~0~~	~~0~~	~~2~~	~~1~~	~~3~~
	~~No Human Interaction~~	~~1~~	~~0~~	~~1~~	~~0~~	~~3~~	~~5~~
	~~CBD~~	~~1~~	~~0~~	~~4~~	~~0~~	~~1~~	~~6~~
~~Brevard~~							

	Total Stranded	**23**	**29**	**21**	**32**	**41**	**146**
	Human Interaction						
	— Fishery Interaction	3	6	3	8	5	25
	— Other	0	1	0	2	2	5
	No Human Interaction	5	6	2	4	4	21
	CBD	15	16	16	18	30	95
Indian River							
	Total Stranded	**5**	**2**	**3**	**0**	**3**	**13**
	Human Interaction						
	— Fishery Interaction	1	0	0	0	1	2
	— Other	0	1	1	0	0	2
	No Human Interaction	2	1	1	0	0	4
	CBD	2	0	1	0	2	5
St. Lucie							
	Total Stranded	**2**	**1**	**1**	**1**	**2**	**7**
	Human Interaction						
	— Fishery Interaction	0	0	0	0	1	1
	— Other	0	0	0	1	0	1
	No Human Interaction	1	1	0	0	1	3
	CBD	1	0	1	0	0	2
Martin							
	Total Stranded	**3**	**0**	**4**	**3**	**0**	**10**
	Human Interaction						
	— Fishery Interaction	2	0	0	0	0	2
	— Other	0	0	0	0	0	0
	No Human Interaction	0	0	0	2	0	2
	CBD	1	0	4	1	0	6
TOTAL							
	Total Stranded	**36**	**32**	**35**	**38**	**51**	**192**
	Human Interaction						
	— Fishery Interaction	7	6	4	8	7	32
	— Other	0	2	1	5	3	11
	No Human Interaction	9	8	4	6	8	35
	CBD	20	16	26	19	33	114

[a] Includes a mass stranding of 2 animals in December 2007

Between 2003 and 2007, 5 bottlenose dolphins recovered by the Stranding Network within the IRLES displayed evidence of interaction with a trap/pot fishery (i.e., rope and/or pots attached) (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). Four of the dolphins had been entangled in pots (0.8 dolphins per year on average). Two of the 4 entangled dolphins were recovered dead (one of which also had multiple sections of blubber removed, possibly post mortem), 1 was released from the pot alive and 1 dolphin was recovered alive, disentangled from a pot, and was placed into rehabilitation. This dolphin, a calf, eventually lost her fluke due to severe tissue damage from the pot line and is in permanent care at Clearwater Marine Aquarium in Clearwater, Florida. The fifth dolphin had no signs of entanglement but an escape ring from a crab pot was found in its stomach upon necropsy. An additional 2 dolphins were reported by the public as entangled in pots or rope with buoys attached (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). In both of these cases, the dolphins were sighted alive and then could not be relocated. It is unclear whether these animals freed themselves or died and sank. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, interaction with the crab fishery does occur and results in mortalities of bottlenose dolphins in the IRLES.

Between 2007 and 2011, 6 bottlenose dolphins documented by the Stranding Network within the IRLES

displayed evidence of interaction with a trap/pot fishery (i.e., rope and/or pots attached) (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). Two of the animals were mortalities. Three animals were disentangled from crab pot gear (identified as commercial blue crab pot gear in two cases) and released alive without serious injury (Maze-Foley and Garrison in prep.). One dolphin had no external signs of entanglement but an escape ring from a blue crab pot was found in its stomach upon necropsy. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, interaction with the crab fishery does occur and results in mortalities of bottlenose dolphins in the IRLES.

Hook and Line Fisheries

Stranding data from 1997 through 2009 were used to investigate hook and line gear interactions with bottlenose dolphins in the IRLES (Stolen *et al.* 2012). During the 13-year study, 57 dolphins (16% of dolphins examined) were found with evidence of fishing gear (single or multi-strand line, fishing hooks, metal sinkers, swivels, and/or lures). Forty-five dolphins ingested gear, 10 dolphins had gear externally wrapped or embedded, and in 2 instances gear was present both externally and internally. In total, 18 interactions (32%) with gear were considered fatal (gear was cause of death) and 23 (40%) were considered incidental (gear did not cause significant tissue or functional damage). While ingested gear was more common than external gear interactions, in most cases it was considered not fatal. However, interactions involving ingested line wrapped around the base of the larynx were always fatal. Occurrence of gear entanglements was less frequent than ingestion of gear but was almost always considered severe and often fatal. Stolen *et al.* (2012) noted that the nature of this study resulted in a conservative estimate of the effects of hook and line fishing for several reasons, including: nonlethal effects of gear interactions could not be determined; carcasses with gear interactions may not always be found by stranding personnel; and animals decompose rapidly in Florida making entanglement difficult to document.

Between 2007 and 2011, there were 27 documented strandings with evidence of hook and line fishery interaction (see Other Mortality below).

Other Mortality

A total of ~~192~~218 bottlenose dolphin~~s~~ strandings were ~~found stranded~~documented within the IRLES from ~~2003~~2007 through ~~2007~~2011 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~10 November 2008~~13 September 2012). Evidence of human interactions (~~HI;~~ e.g., fishing gear ~~and~~or debris entanglement or ingestion, mutilation, boat collision) was detected for ~~43~~44 strandings; ~~,~~ no evidence of human interactions was found for 37 animals, and for the remaining 137 animals, it could not be determined if there was evidence of human interactions. Thirty-six of the 44 strandings for which evidence of human interactions ~~were~~was detected involved fisheries interactions, including the ~~7~~6 crab pot interactions discussed above. Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008; Stolen *et al.* 2012). ~~Twenty-five animals~~One dolphin stranded dead entangled in trammel net gear (in 2008). Twenty-seven strandings showed evidence of interaction with hook and line fishing gear, including entanglement in or ingestion of monofilament line, hooks or lures. These interactions may or may not have been the cause of the animal's death, and in some cases the relationship between the gear and cause of death could not be determined.

Two identified dolphins from the IRLES were disentangled from fishing gear multiple times. One dolphin was disentangled and released alive on 3 separate occasions (Maze-Foley and Garrison in prep.), and subsequently stranded dead entangled in fishing gear. The second dolphin stranded dead as a result of tail fluke entanglement in fishing gear following 3 prior disentanglement and live release interventions. In addition to these 2 identified dolphins, there were also other live strandings entangled in hook and line gear, crab pot gear, or debris, and 1 was considered to be seriously injured (see Maze-Foley and Garrison in prep.).

In addition to animals included in the stranding database, in 2008 and 2010, there were at-sea observations in the IRLES area of a dolphin entangled in fishing gear (wrapped around body parts). Both dolphins were considered seriously injured (Maze-Foley and Garrison in prep.).

~~Four of the 25 animals stranded alive. Two of these died shortly after stranding, 1 animal could not be relocated after the initial report, and 1 was disentangled from monofilament line and released. Two animals were entangled in monofilament line and had also ingested marine debris, which was found during the necropsy.~~

~~Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly in areas of the Indian River Lagoon. Feeding wild dolphins is defined under the MMPA's implementing regulations as a form of~~

~~"take" because it can alter the dolphins' natural behavior and increase their risk of injury or death. There are emerging questions regarding potential linkages between provisioning wild dolphins, dolphin depredation of recreational fishing gear, and associated entanglement and ingestions of gear, which is increasing through much of Florida.~~

~~The remaining 10 cases of HI were not related to interactions with fishing gear. Of these, 6 animals had evidence of boat strike, some of which were old healed wounds, others were recent. One animal was found alive entangled in marine debris and was disentangled and released. Upon necropsy, 2 other animals were found to have ingested marine debris (bringing ingestion of marine debris to a total of 5 animals overall). One animal was found with a 13cm square of blubber cut from the peduncle, possibly postmortem (bringing the total cases of carcass mutilation to 2 including the crab pot animal with blubber removed, discussed above). Another case of HI involved a person who tried to tow a live stranded dolphin back out to sea before reporting it and may have inadvertently injured it in the process. As with HI involving fishing gear, HI in the other cases may or may not have been the cause for stranding or death of the animal.~~

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some of the stranded dolphins may have been from a nearby coastal stock, although the proportion of stranded dolphins belonging to another stock cannot be determined because it is often unclear from where the stranded carcasses originated. However, preliminary analyses of photo-ID data suggest that many of the stranded dolphins with distinct dorsal fins found within the IRLES had been photographed within the estuary previously, and furthermore, many of them were found within their known photo-ID home ranges (Mazzoil~~, Stolen and Noke~~ *et al.*, in preparation). Stranding data probably underestimate the extent of mortality and serious injury resulting from HI because not all of the dolphins that die or are seriously injured in HI wash ashore, nor will all of those that do wash ashore necessarily show signs of HI. Finally, ability to recognize HI varies widely due to many factors including the condition of the carcass (for instance, later stages of decomposition and carcass scavenging).

Bottlenose dolphin stranding data from 1977 to 2005 were analyzed by Stolen *et al.* (2007) to examine spatio-temporal aspects of strandings, age/sex specific mortality patterns and human-related mortality in the IRLES. Stolen *et al.* (2007) reported that 834 total dolphins stranded during the time frame of the study, which ranged from a low of 11 animals in 1985 to a high of 61 animals in 2001. Significant findings were: more strandings occurred in spring and summer; more of the strandings were males; and juveniles stranded more frequently, followed by adults, then calves (Stolen *et al.* 2007). Human interaction (HI) (e.g., gear and debris entanglement or ingestion, mutilation, boat collision) was reported in 10.2% (n=85) of strandings. Significantly more males showed evidence of HI than females. Most strandings with HI evidence were reported in spring and summer and found in Brevard County (n=64). Ingestion of or entanglement in recreational fishing gear accounted for 54.1% (n=46), and commercial fishing interaction accounted for 23.5% (n=20) of strandings where HI was recorded (Stolen *et al.* 2007).

~~In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to provide guidance for responses to such events.~~ In 2001, there was a record high number of strandings in the IRLES (n=61) (Stolen *et al.* 2007). An Unusual Mortality Event (UME) was declared when 34 of these dolphins stranded in a relatively short time period (7 May – 25 August 2001) and were confined to a relatively small geographic area in central Brevard County (Stolen *et al.* 2007). The cause of this UME was undetermined; however, saxitoxin, a biotoxin produced by the algae *Pyrodinium bahamense*, was suspected to be a factor. The IRLES experienced another UME in 2008. From May to August a total of ~~48~~47 bottlenose dolphins were recovered from the northern IRLES. One dolphin from the Central Florida Coastal Stock was also considered part of this UME (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~10 November 2008~~13 September 2012). Infectious disease is suspected~~being considered~~ as a possible cause of this event.

Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly in areas of the Indian River Lagoon. Feeding wild dolphins is defined under the MMPA's implementing regulations as a form of "take" because it can alter the dolphins' natural behavior and increase their risk of injury or death. There are emerging questions regarding potential linkages between provisioning wild dolphins, dolphin depredation of recreational fishing gear, and associated entanglement and ingestions of gear, which is increasing through much of Florida.

Impacts of motorized vessels on bottlenose dolphins in the IRLES were investigated using photo-ID data collected from September 1996 to October 2006 (Bechdel *et al.* 2009). Six percent of distinctly marked individuals

had injuries associated with vessel impact. Two counties, Martin and St. Lucie Counties, had the highest rate (9.9%) of boat-injured dolphins as well as the largest number of registered boaters per km^2 (237 boats/km^2). During sightings with less than 5 vessels within 100m of the dolphin group, changes in the frequency of feeding decreased and traveling increased. Resting behavior was the least observed activity (< 1% of observations) during the 10-year study. Bechdel *et al.* (2009) suggest that continual vessel avoidance, lack of rest, and projected increases in anthropogenic impacts may result in chronic stress for dolphins inhabiting the IRLES.

The IRLES is a shallow water estuary with little tidal influx, which limits water exchange with the Atlantic Ocean. This allows for accumulation of land-based effluents and contaminants in the estuary, as well as fresh-water dilution from run-off and rivers. A large portion of Florida's agriculture also drains into the IRLES, including all of the sugarcane, approximately 38% of citrus and 42% of other vegetable crops (Miles and Pleuffer 1997). Dolphins in the IRLES were found to have concentrations of contaminants at levels of possible toxicological concern. Hansen *et al.* (2004) suggested that polychlorinated biphenyl (PCBs) concentrations in blubber samples collected from remote biopsy of IRLES dolphins were sufficiently high to warrant additional sampling. Fair *et al.* (2010) found potentially harmful levels of several different chemical contaminants, including some that may act as endocrine disruptors. However, there have been no reports of mortalities in the IRLES resulting solely from contaminant concentrations.

~~Hansen *et al.* (2004) speculated that polychlorinated biphenyl (PCBs) concentrations in blubber samples collected from remote biopsy of IRLES dolphins were sufficiently high to warrant additional sampling.~~ Durden *et al.* (2007) found mean mercury concentrations in IRLES dolphins were positively correlated with age and length and tended to be slightly higher than dolphins from the Gulf of Mexico and South Carolina coasts. In the same study, 5 animals were found to have mercury concentrations exceeding 100ppm, which may be associated with toxic effects in marine mammals (Durden *et al.* 2007). Stavros *et al.* (2007, 2008) reported that blood and skin samples obtained from IRLES dolphins had concentrations of total mercury among the highest reported in free-living marine mammals worldwide and approximately 4 to 5 times the concentrations found in dolphins from Charleston, South Carolina. Concentrations of total mercury in IRLES dolphins were associated with lower levels of total thyroxine, triiodothyronine, lymphocytes, eosinophils and platelets and increases in blood urea nitrogen and gamma-glutamyl transferase (Schaefer *et al.* 2011). A further study of IRLES dolphins indicated that 33% of the stranded and 15% of the free-ranging dolphins from Florida exceeded the minimum 100 lg g 1 wet weight (ww) Hg threshold for hepatic damage previously published for marine mammals (Stavros *et al.* 2011).~~Blood and skin samples obtained from IRLES dolphins during the Bottlenose Dolphin Health and Risk Assessment Project (HERA) contain concentrations of total mercury among the highest reported in free-living marine mammals worldwide and approximately five and four times the concentrations found in dolphins from the Charleston, South Carolina, area in skin and blood respectively (Stavros *et al.* 2007, 2008). Recent evidence shows that mercury is associated with endocrine, hepatic, renal and hematologic effects (Schaefer *et al.* 2011). Concentrations of total mercury in IRLES dolphins were associated with lower levels of total thyroxine, triiodothyronine, lymphocytes, eosinophils and platelets and increases in blood urea nitrogen and gamma-glutamyl transferase (Schaefer *et al.* 2011). A further study of IRLES dolphins indicated that 33% of the stranded and 15% of the free-ranging dolphins from Florida exceed the minimum 100 lg g 1 wet weight (ww) Hg threshold for hepatic damage previously published for marine mammals (Stavros *et al.* 2011). Mercury concentrations in blood and skin of IRLES dolphins have also been shown to be associated with decreases in both innate and adaptive immunity (J. Reif , Colorado State University, pers. comm.).~~

~~IRLES dolphins also carry burdens of both legacy and emerging organic chemicals that may impact directly or lead to increased susceptibility to infectious diseases by decreasing immunocompetence. Hansen *et al.* (2004) speculated that polychlorinated biphenyl (PCBs) concentrations in blubber samples collected from remote biopsy of IRLES dolphins were sufficiently high to warrant additional sampling. Blubber samples from surgical biopsies taken from bottlenose dolphins in the IRLES were analyzed by Fair *et al.* (2007) for polybrominated diphenyl ethers (PBDEs), establishing baseline levels for this current use compound.~~Further studies of contaminant levels of organic chemicals in IRLES dolphins have documented the presence of potentially harmful concentrations of PCBs, pesticides and polyaromatic hydrocarbons as well as PBDEs and polyfluorinated compounds (PFCs) that appear to act as endocrine disruptors and immunosupressants in laboratory animals and humans (Fair *et al.* 2010). Studies to identify health effects of these exposures are in progress; however, there have been ~~There are no reports of mortalities in the IRLES resulting solely from contaminant concentrations.~~

Recent studies of IRLES dolphins ~~examined during HERA~~ have shown evidence of infection with the cetacean morbillivirus~~, creating concern that an epizootic of this disease could occur~~. Positive morbillivirus titers were found in 12 of 122 (9.8%) IRLES dolphins sampled between 2003 and 2007 (Bossart *et al.* 2010). In addition,

aApproximately 10% of

Bbottlenose dolphins captured in the IRLES during the Health and Risk Assessment (HERA) project had lacaziosis (lobomycosis), a chronic mycotic disease of the skin caused by *Lacazia loboi* (Reif *et al.* 2006) and orogenital papillomatosis (Bossart *et al.* 2005). Results indicated that of the 89 dolphins captured in the IRLES, 9 (10.1%) had lobomycosis and 10 (11.2%) had orogenital papillomatosis (Reif *et al.* 2008). All 9 dolphins with lobomycosis were from the southern portion of the IRLES (Reif *et al.* 2006). Afflicted dolphins showed no significant difference in prevalence of the disease between sexes and were significantly older than non-afflicted dolphins (Reif *et al.* 2006). The prevalence of lacaziosis was also studied through examination of photo-ID data between 1996 and 2006 and was estimated to be 6.8% (Murdoch *et al.* 2008). There are no published reports of mortalities resulting solely from this disease.Basis for presence and localization of lobomycosis to the southern portion of the IRLES is currently unknown, but may be related to immunosupression and environmental factors such as freshwater influx and exposure to contaminants (Reif *et al.* 2006). There are no reports of mortalities resulting solely from infection of either disease.

Table 2. Bottlenose dolphin strandings by county within the Indian River Lagoon System from 2007 to 2011, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (accessed 13 September 2012). Please note human interaction does not necessarily mean the interaction caused the animal's death.

COUNTY		2007	2008	2009	2010	2011	TOTAL
Volusia	**Total Stranded**	**5[a]**	**6[b]**	**2**	**1**	**6**	**20**
	Human Interaction						
	---Yes	1	3	1	1	2	8
	---No	3	0	0	0	1	4
	---CBD	1	3	1	0	3	8
Brevard	**Total Stranded**	**41**	**61[c]**	**25**	**32**	**18**	**177**
	Human Interaction						
	---Yes	7	13	3	5	1	29
	---No	5	10	4	6	3	28
	---CBD	29	38	18	21	14	120
Indian River	**Total Stranded**	**3**	**0**	**1**	**2**	**1**	**7**
	Human Interaction						
	---Yes	1	0	0	0	0	1
	---No	0	0	0	0	0	0
	---CBD	2	0	1	2	1	6
St. Lucie	**Total Stranded**	**2**	**2**	**1**	**0**	**5**	**10**
	Human Interaction						
	---Yes	1	1	0	0	4	6
	---No	1	1	1	0	1	4
	---CBD	0	0	0	0	0	0
Martin	**Total Stranded**	**0**	**0**	**1**	**1**	**2**	**4**
	Human Interaction						
	---Yes	0	0	0	0	0	0
	---No	0	0	0	0	1	1
	---CBD	0	0	1	1	1	3
TOTAL	Total Stranded	**51**	**69**	**30**	**36**	**32**	**218**

Human Interaction						
---Yes	10	17	4	6	7	44
---No	9	11	5	6	6	37
---CBD	32	41	21	24	19	137

[a] Includes a mass stranding of 2 animals in December 2007
[b] Includes 3 animals that were considered part of the 2008 UME event
[c] Includes 44 animals that were considered part of the 2008 UME event

STATUS OF STOCK

~~From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the IRLES Stock is currently unknown, but likely small, and relatively few mortalities and serious injuries would exceed PBR, ~~the~~ NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. The documented annual average human-caused mortality for this stock for 2007 – 2011 is unknown. However, there are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. In particular, the impact of crab trap/pot fisheries on estuarine bottlenose dolphins is currently unknown, but has been shown previously to be considerable in the similar Charleston Estuarine System Stock area (Burdett and McFee 2004). Therefore, any documented mortalities must be considered minimum estimates of total fishery-related mortality. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

Documented human-caused mortalities from hook and line gear and crab pot gear entanglements as well as repeated UMEs (2 since 2001) reinforce concern for this stock. The removal of dolphins in live-capture fisheries in the 1970's and 1980's is also cause for concern; however, the effects of the permanent removals and the mortality events on stock abundance have not yet been completely determined. Stolen and Barlow (2003) concluded that the population's growth rate was stable or increasing from a model life table that was based on stranding data collected from 1978 to 1997 and incorporated the live capture removals. The limited ranging behavior of potentially 3 or more discrete dolphin communities and the geographic localization of previous UMEs suggest that mortality impacts may be more significant when analyzed on a smaller spatial scale.

~~The status of the IRLES stock relative to OSP is unknown. This species is not listed as threatened or endangered under the Endangered Species Act and there are insufficient data to determine population trends for this stock. The removal of dolphins in live-capture fisheries in the 1970's and 1980's and the occurrence of 2 UMEs of bottlenose dolphins in the IRLES since 2001 (NMFS unpublished data) is cause for concern; however, the effects of the permanent removals and the mortality events on stock abundance have not yet been determined. The limited ranging behavior of potentially 3 or more discrete dolphin communities and the geographic localization of previous UMEs suggest that mortality impacts may be more significant when analyzed on a smaller spatial scale.~~

~~Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Documented human-caused mortalities in recreational fishing gear entanglement and repeated UMEs reinforce concern for this stock. Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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~~December 2009~~

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Biscayne Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. ~~Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2009), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports.~~ Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data).~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

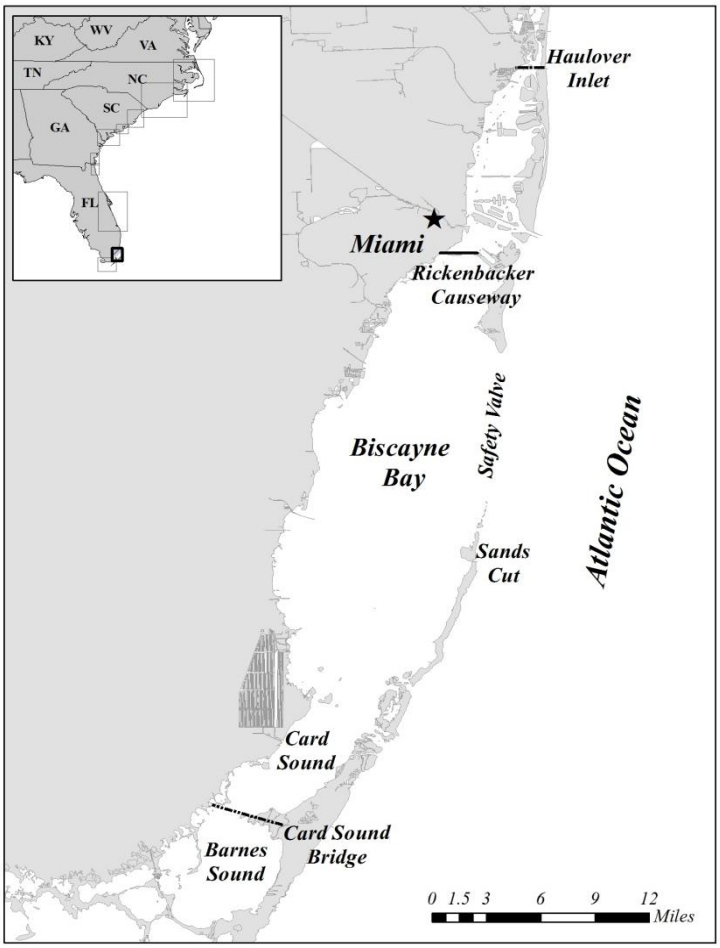

Figure 1. *Geographic extent of the Biscayne Bay stock. Dashed lines denote the boundaries.*

Biscayne Bay is a shallow estuarine system located along the southeast coast of Florida in Miami-Dade county. The Bay is generally shallow (depths <5m) and includes a diverse range of benthic communities including seagrass beds, soft coral and sponge communities, and mud flats. The northern portion of the Bay (Figure 1) is surrounded by the cities of Miami and Miami Beach and is therefore heavily influenced by industrial and municipal pollution sources. ~~The water flow in this portion of the Bay is very restricted due to the~~ Furthermore, tidal flushing in this portion of the Bay is severely limited by the presence ~~construction~~ of dredged islands (Bialczak *et al.* 2001). In contrast, the central and southern portions of the Bay are less influenced by development and are better flushed. Water exchange with the Atlantic Ocean occurs through a broad area of grass flats and tidal channels termed the Safety Valve near

the center of the Bay. The Bay extends south through Card Sound and Barnes Sound, and connects through smaller inlets to Florida Bay (Figure 1). The Biscayne Bay sStock of bottlenose dolphins is bounded by Haulover Inlet to the north and Card Sound bridge to the south. This range corresponds to the extent of confirmed home ranges of bottlenose dolphins observed residing in Biscyane Bay by a long-term photo-ID study conducted by the Southeast Fisheries Science Center (Litz 2007; SEFSC unpublished data). It is likely that the range of Biscyane Bay dolphins extends past these boundaries; however, there have been few surveys outside of this range. These boundaries are subject to change upon further study of dolphin home ranges within the Biscayne Bay estuarine system and comparison to an extant photo-ID catalog from Florida Bay to the south.

Dolphins residing within estuaries north of this stock along the southeastern coast of Florida are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals in this region exhibit affiliation to the Biscayne Bay sStock, the estuarine stock further to the north in the Indian River Lagoon Estuarine System (IRLES), or are simply transient animals associated with coastal stocks. There is relatively limited estuarine habitat along this coastline; however, the Intracoastal Waterway extends north along the coast to the IRLES. It should be noted that during 2003-2007-2011, there were 3was 1 stranded bottlenose dolphins in this region in enclosed waters. One of these had signs of human interaction from a boat strike and another was identified as an offshore morphotype bottlenose dolphin. It could not be determined if there were any signs of human interactions for this stranded animal.

Bottlenose dolphins have been documented in Biscayne Bay since the 1950-s (Moore 1953). Live capture fisheries for bottlenose dolphins are known to have occurred throughout the southeastern U.S. and within Biscayne Bay during the 1950-s and 1960-s; however, it is unknown how many individuals may have been removed from the population during this period (Odell 1979; Wells and Scott 1999).

The Biscayne Bay Stock of bottlenose dolphins stock has been the subject of an ongoing photo-ID study conducted by the NMFS Southeast Fisheries Science Center since 1990. From 1990 to 1991, preliminary information was collected focusing on the central portion of the Bay. The survey was re-initiated in 1994, and it was expanded to include the northern portion of the Bay and south to the Card Sound Bridge in 1995 (SEFSC unpublished data; Litz 2007). Through 2007, the photo-ID catalog included 229 unique individuals. Approximately 80% of these individuals may be long-term residents with multiple sightings over the 17 years of the study (SEFSC unpublished data). Analyses of the sighting histories and associations of individuals from the Biscayne Bay photo-ID data demonstrated that there are at least 2 overlapping social groups of animals within Biscayne Bay segregated along a north/south gradient (Litz 2007).

Litz (2007) documented two social groups that differentially utilize habitats within Biscayne Bay; one group was sighted primarily in the northern half of the Bay while the other was sighted primarily in the southern half. Members of these two groups exhibited significant differences in contaminant loads (Litz *et al*. 2007). Evidence of weak but significant genetic differentiation was found between these two social groups using microsatellite data but not mitochondrial DNA (mtDNA) data (Litz *et al*. 2012). The lack of differentiation at mtDNA coupled with field observations indicating overlapping home ranges for these two groups suggests ongoing, though perhaps low, levels of interbreeding and the two groups have not been split into separate stocks at this time. Remote biopsy samples of Biscayne Bay animals were collected between 2002 and 2004 for analyses of population genetic structure and persistent organic pollutant concentrations in blubber. Genetic structure was investigated using both mitochondrial DNA (mtDNA) and nuclear (microsatellite) markers, and the data from Biscayne Bay were compared to data from Florida Bay dolphins to the south (Litz *et al.* 2012007). Within Biscayne Bay, dolphins sighted primarily in the northern half of the Bay were significantly differentiated from those sighted primarily in the southern half at the microsatellite loci but not at the mitochondrial locus. There was not sufficient genetic differentiation between these groups to indicate true population subdivision (Litz *et al.* 2012007). However, significant genetic differentiation was found between the Biscayne Bay and Florida Bay dolphins in at both markers marker types (Litz *et al.* 2012007). The observed genetic differences between resident animals in Biscayne Bay and those in an adjacent estuary combined with the high levels of sight fidelity observed, demonstrate that the resident Biscayne Bay bottlenose dolphins are a demographically distinct population stock.

Biscayne The Bay extends south through Card Sound and Barnes Sound, and connects through smaller inlets to Florida Bay (Figure 1). The Biscayne Bay Stock of bottlenose dolphins is bounded by Haulover Inlet to the north and Card Sound bridge to the south. This range corresponds to the extent of confirmed home ranges of bottlenose dolphins observed residing in Biscyane Bay by a long-term photo-ID study conducted by the Southeast Fisheries Science Center (Litz 2007; SEFSC unpublished data) and probably represents the core range of this stock. Biscyayne Bay dolphins may utilize habitats outside these boundaries, but there have been few surveys outside of

this range. These boundaries are subject to change upon further study of dolphin home ranges within the Biscayne Bay estuarine system and comparison to an extant photo-ID catalog from Florida Bay to the south.

Dolphins residing within estuaries north of this stock to Jupiter Inlet are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals in this region exhibit affiliation to the Biscayne Bay Stock, the estuarine stock further to the north in the Indian River Lagoon Estuarine System (IRLES), or are simply transient animals associated with coastal stocks. There is relatively limited estuarine habitat along this coastline; however, the Intracoastal Waterway extends north along the coast to the IRLES. It should be noted that during 2007-2011, there was 1 stranded bottlenose dolphin in this region in enclosed waters. It could not be determined if there were any signs of human interactions for this stranded animal.

POPULATION SIZE

The total number of bottlenose dolphins residing within the Biscayne Bay ~~s~~Stock is unknown. An initial evaluation of the abundance of bottlenose dolphins in Biscayne Bay was conducted with aerial surveys in 1974-1975 covering predominantly the central portion of the Bay from Rickenbacker Causeway to the northern end of Card Sound. Bottlenose dolphins were observed in the Bay on 7 of 22 aerial surveys with the sightings totaling 67 individuals. Only 1 group was seen on each survey. This led the authors to conclude that there was likely 1 herd of approximately 13 animals occupying the Bay (Odell 1979). It was noted that this encounter rate was much lower than that in the adjacent Everglades National Park, and that the apparent low density of dolphins in Biscayne Bay had limited the effectiveness of the collection of live animals for display.

Between 1994 and 2007, 394 small boat surveys of Biscayne Bay were conducted for the bottlenose dolphin photo-ID study. A day's survey effort covered either the northern (Haulover Inlet to Rickenbacker Causeway), central (Rickenbacker Causeway to Sands Cut) or southern (Sands Cut to Card Sound Bridge) region of the Bay. Each area was surveyed 8-12 times per year on a monthly basis from 1994 to 2003. From 2003 to 2007, the number of surveys was lower and ranged between 4 and 8 per year, and the lowest amount of effort was expended in the southern portion of the Bay. When dolphins were encountered, estimates of group size were made, and photographs of fins were taken of as many individuals as possible. The fins were cataloged and individuals identified using standard methods (SEFSC unpublished data). There were 157 unique individuals identified in the photo-ID surveys between 2003 and 2007. However, this catalog size does not represent a valid estimate of population size because the residency patterns of dolphins in Biscayne Bay are not fully understood. It is currently not possible to develop a mark-recapture estimate of population size from the photo-ID catalog. However, research is currently underway to estimate the abundance of the Biscayne Bay ~~s~~Stock using a photographic mark-recapture method.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the Biscayne Bay ~~s~~Stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the Biscayne Bay ~~s~~Stock of bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the Biscayne Bay ~~s~~Stock of bottlenose dolphins is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury for the Biscayne Bay ~~s~~Stock during ~~2003-2007~~2007-2011 is unknown. No interactions with crab or lobster pot gear or hook and line gear were documented; however, it is not possible to estimate the total number of interactions or mortalities associated with crab or lobster pots or hook and line fisheries since there are no systematic observer programs. ~~as there are no observed fisheries or estimates of total mortality. However, there was 1 documented mortality associated with the stone crab fishery in 2006. Thus, the minimum annual commercial fishery-caused mortality for 2003-2007 is estimated as 0.2 animals per year.~~

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

There is a potential for the Biscayne Bay Stock to interact with the Category II Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot fishery and the Category III Florida spiny lobster trap/pot fishery. This stock may also interact with the Category III Atlantic commercial passenger fishing vessel (hook and line) fishery (Appendix III).~~There have been several documented mortalities of Biscayne Bay bottlenose dolphins in crab and lobster pot fisheries. There is no systematic observer coverage of these fisheries, therefore it is not possible to quantify total mortality.~~

Crab and Lobster Pots

~~There have been 3~~ During 2007-2011 there were no documented mortalities or serious injuries of bottlenose dolphins in Biscayne Bay associated with entanglement in crab and lobster pot fisheries. Three mortalities were documented in prior years. One entanglement mortality was documented in 1997 in lobster pot gear just outside of the opening of the Bay to the Atlantic Ocean on the eastern edge of the Safety Valve area. In 2002, an entanglement mortality was observed in the central portion of the Bay in a stone crab pot. Finally, in 2006 there was an entanglement mortality of a known Biscayne Bay resident animal, also in a stone crab pot. This entanglement occurred in the northern portion of the Bay.

Hook and Line Fisheries

There have been 2 mortalities of known resident Biscayne Bay bottlenose dolphins associated with ingestion and/or entanglement of recreational fishing gear including hooks and monofilament line. These mortalities occurred during 1990 and 1999.

Other Mortality

~~There have been 2 mortalities of known resident Biscayne Bay bottlenose dolphins associated with ingestion and/or entanglement of recreational fishing gear including hooks and monofilament line. These mortalities occurred during 1990 and 1999.~~

~~There were 3 additional stranded animals occurring inside Biscayne Bay between 2003 and 2007 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 10 November 2008). The first occurred in 2004, and it was confirmed to be of the offshore morphotype by genetic testing and therefore not a Biscayne Bay resident. Two animals stranded in 2006, and 1 of these was a known Biscayne Bay resident. No definitive evidence of human interaction was detected for either of these animals; however human interaction could not be ruled out in either case.~~ There were 8 stranded animals occurring inside Biscayne Bay between 2007 and 2011 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012). One animal showed signs of human interactions in the form of propeller wounds, but these wounds may have occurred post-mortem. For 1 animal no evidence of human interactions was detected, and for the remaining 6 animals, it could not be determined if any human interactions had occurred.

The nearshore and estuarine habitats occupied by dolphins are adjacent to areas of high human population and

some are highly industrialized. Recent studies have examined persistent organic pollutant concentrations in bottlenose dolphin tissues from several estuaries along the Atlantic coast and have likewise found evidence of high pollutant concentrations in blubber, particularly near Charleston, South Carolina, and Beaufort, North Carolina (Hansen *et al.* 2004). The concentrations found in male dolphins from both of these sites exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002; Hansen *et al.* 2004). A study of persistent organic pollutants in bottlenose dolphins of Biscayne Bay demonstrated a strong geographic gradient in pollutant concentrations between dolphins with sighting histories primarily in the northern, more polluted areas compared to dolphins with ranges in the southern portion of the Bay (Litz *et al.* 2007). The observed tissue concentrations of polychlorinated biphenyls (PCBs) for male animals from the northern Bay were 5 times higher than those in southern Biscayne Bay and were also higher than those of dolphins from other Atlantic estuaries including Beaufort, North Carolina, Charleston, South Carolina, Indian River Lagoon, Florida, and Florida Bay (Litz *et al.* 2007). These findings demonstrate differential exposure of bottlenose dolphins to pollutants through the food chain on a very fine spatial scale within Biscayne Bay and between estuaries.

STATUS OF STOCK

~~From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act. However, because the abundance of the Biscayne Bay Stock is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, ~~the~~ NMFS considers this to be a strategic stock under the Marine Mammal Protection Act. There are no documented human-caused mortalities for this stock for 2007 – 2011~~. However~~, although~~,~~ entanglements in lobster and crab pot fisheries and in hook and line fisheries have been documented in prior years. There are several commercial fisheries operating within this stock's boundaries and these fisheries have little to no observer coverage. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock.

~~The status of the Biscayne Bay stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. The total human caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Documented human caused mortalities in recreational fishing gear entanglement and ingestion of gear reinforce concern for this stock. Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.~~

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~~December 2009~~

COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Florida Bay Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of common bottlenose dolphins is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. ~~Except for animals residing within the Southern North Carolina and Northern North Carolina Estuarine Systems (e.g., Waring *et al.* 2007), estuarine dolphins along the U.S. east coast have not previously been included in stock assessment reports.~~ Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several inshore areas of the southeastern United States (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz *et al.* 2012~~07~~), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied in coastal and estuarine areas along the Atlantic coast (Rosel *et al.* 2009), and between those biopsied in coastal and estuarine waters at the same latitude (NMFS unpublished data). ~~Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data).~~ Similar results have been found off the west coast of Florida (Sellas *et al.* 2005).

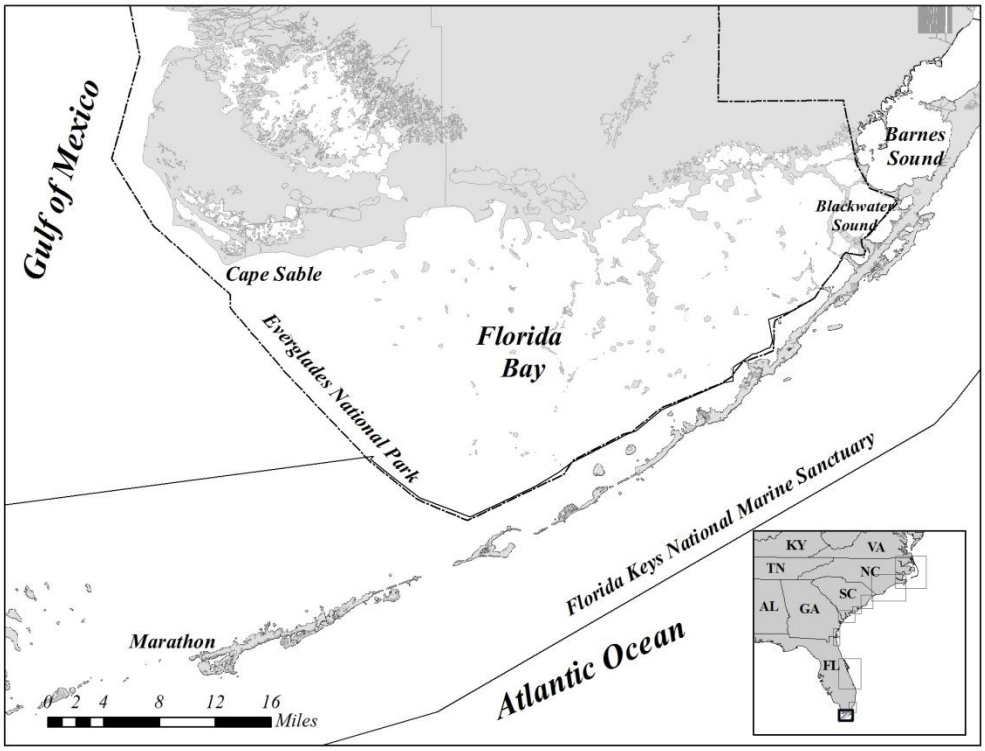

Figure 1. *Geographic extent of the Florida Bay stock. The boundaries of Everglades National Park and Florida Keys National Marine Sanctuary are shown.*

Florida Bay is a shallow estuarine system that lies between the mainland of Florida and the Florida Keys and encompasses 2,200 ~~-~~km^2 of interconnected basins, grassy mud banks and mangrove islands. Florida Bay is bordered by the Florida mainland to the north, by the Florida Keys and Atlantic Ocean to the southeast, and by the Gulf of Mexico to the west. The western boundary of the Everglades National Park is generally considered to be the boundary between Florida Bay and the Gulf of Mexico. Here, Barnes Sound is not considered to be part of Florida Bay (Figure 1). Florida Bay was historically fed by runoff from the Everglades through marsh-like prairies called

sloughs and a number of nearby creeks or inlets. The Bay connects through smaller inlets to Biscayne Bay, between Blackwater Sound and Barnes Sound. Freshwater flow from the Everglades is a major influence on the conditions within the Bay, particularly since tides have little effect on water levels due to mud banks ~~which~~ that restrict water flow (Fourqurean and Robblee 1999).

~~The Florida Bay resident stock of bottlenose dolphins is considered to occur both within the bounds of Florida Bay and within the Gulf of Mexico side portion of the Florida Keys National Marine Sanctuary (FKNMS) southwest to Marathon, Florida (Figure 1). The acutal range of the resident animals is unknown, but it likely extends beyond the boundaries of Florida Bay at times. For example, the range of Florida Bay dolphins may extend north into Barnes Sound; however, there have been few surveys of this area. In addition, it is likely that transient animals occur within the Florida Bay boundaries including perhaps offshore morphotype animals that move onshore from nearby oceanic waters. These boundaries are subject to change upon further study of dolphin home ranges within the Florida Bay estuarine system and comparison to an extant photo-ID catalog from Biscayne Bay to the north. The preliminary comparison of the Biscayne Bay and Florida Bay photo-ID catalogs revealed 13 matched animals, in which about 25% of these matched animals were only documented near the Barnes Sound boundary between Florida Bay and Biscayne Bay (NMFS unpublished data; Dolphin Ecology Project unpublished data). This initial comparison does suggest that there is movement between these two genetically distinct stocks across currently defined stock boundaries.~~

Live capture fisheries for bottlenose dolphins are known to have occurred throughout the southeastern U.S. ~~and~~, including ~~within~~ Florida Bay. An active bottlenose dolphin live-capture fishery operating between 1962 and 1973 in the Florida Keys permanently removed 70 bottlenose dolphins for ~~captive~~ display in marine parks. Thirteen of these dolphins were confirmed removals from Florida Bay, and it is likely the remaining animals were from Florida Bay as well, but the absence of specific geographic data in the marine mammal inventory makes it difficult to confirm the remaining removal locations. No dolphins have been removed from Florida Bay or the Florida Keys since 1973 (NMFS Marine Mammal Inventory, July 24, 2004).

During 1995-1997, aerial surveys were conducted in Florida Bay to census bird populations, and opportunistic sightings of bottlenose dolphins were recorded. While these surveys did not estimate the abundance of bottlenose dolphins, the surveys documented the presence of dolphins in Florida Bay throughout the year (McClellan *et al.* 2000). Biopsy sampling was conducted in 1998 and 2002 for contaminant analyses (Fair *et al.* 2003). Sub-samples were later used for genetic analysis~~, and this study~~ which ~~found~~ revealed significant genetic differentiation between Florida Bay and Biscayne Bay to the north (Litz *et al.* 2012~~07~~)

~~The~~ Dolphins in Florida Bay ~~Stock of bottlenose dolphins stock has~~have been the subject of an ongoing photo-ID study by the Dolphin Ecology Project since 1999. From 1999 to 2000, preliminary information was collected focusing on the eastern, Atlantic, and central areas of the Bay, and in 2001 the surveys were expanded to include the western portion of the Bay including the region of transition to the Gulf of Mexico. Typically, photo-ID surveys were conducted during the 2 seasons of most extreme rainfall levels in Florida Bay, summer (the wet season, May-October) and winter (the dry season, November-April), allowing for the assessment of seasonal variation in the distribution of dolphins (Engleby *et al.* 2002). Surveys were conducted by a small vessel using standard photo-ID methods. Through 2007, the photo-ID catalog included 577 unique individuals. Sighting data confirm that dolphins range throughout the Bay and are present year-round (Engleby, unpublished data.)

During the summer (June-August) from 2002 to 2005, a study to investigate top predator (sharks and dolphins) distribution and foraging ecology was conducted in Florida Bay. The sighting histories of 437 unique individual dolphins further confirmed that dolphins are present in all areas of the Bay and demonstrate high individual site and foraging tactic fidelity (Torres 2007).

The Florida Bay resident stock of bottlenose dolphins is considered to occur both within the bounds of Florida Bay and within the Gulf of Mexico-side portion of the Florida Keys National Marine Sanctuary (FKNMS) southwest to Marathon, Florida (Figure 1). The acutal range of the resident animals is unknown, but it likely extends beyond the boundaries of Florida Bay at times. For example, the range of Florida Bay dolphins may extend north into Barnes Sound; however, there have been few surveys of this area. A preliminary comparison of the Biscayne Bay and Florida Bay photo-ID catalogs revealed 13 matched animals with approximately 25% of these matched animals documented only near the Barnes Sound boundary between Florida Bay and Biscayne Bay (NMFS unpublished data; Dolphin Ecology Project unpublished data). This initial comparison suggests there may be some spatial overlap of these two genetically distinct stocks at the stock boundary. It is also likely that transient animals occur within the Florida Bay boundaries, including perhaps offshore morphotype animals that move onshore from nearby oceanic waters. The boundaries for the Florida Bay Stock are subject to change upon further study of dolphin

home ranges within the Florida Bay estuarine system.

POPULATION SIZE

Population size estimates for this stock are greater than 8 years old and therefore the current population size for the stock is considered unknown (Wade and Angliss 1997). The first mark-recapture abundance survey of bottlenose dolphins in Florida Bay was conducted during May 2003 using photo-ID methods (Read *et al.*, in review). This survey resulted in a best estimate for abundance of bottlenose dolphins in Florida Bay of 514 (CV=0.17; Read *et al.*, in review). This estimate accounts for the proportion of the population with unmarked fins. The mark-recapture abundance estimate is comparable to a direct count of known individuals from a long-term photo-ID catalog (n=577) and work by Torres (2007), which documented 437 individuals during summer months. Each of these counts or estimates of population size does not effectively distinguish resident from non-resident animals in the Bay and so are likely overestimates of the resident population.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the Florida Bay Stock of bottlenose dolphins.~~The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for this stock is 514 (CV=0.17) obtained from the mark-recapture survey (Read *et al.* in review). The minimum population estimate for the Florida Bay stock of bottlenose dolphins is therefore 447.~~

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the Florida Bay ~~s~~Stock of bottlenose dolphins is unknown~~447~~. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the Florida Bay ~~s~~Stock of bottlenose dolphins is undetermined~~4.5~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There was 1 documented report of a fishery-related mortality or serious injury to this stock between 2007 and 2011. The report was an at-sea observation of a dolphin seriously injured due to an interaction with the hook and line fishery (Maze-Foley and Garrison in prep.).

~~There are no documented reports of fishery-related mortality or serious injury to this stock between 2003 and 2007. However, 1 bottlenose dolphin was entangled in a lobster pot and released alive in unknown condition.~~

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fishery Information

Most of Florida Bay lies within the boundaries of the Everglades National Park with a smaller portion that lies within the FKNMS. Commercial fishing in the Everglades National Park is prohibited. The majority of recreational fishing is hook and line, although dip nets, cast nests and landing nets are also used. The predominant commercial fishery in the FKNMS is stone crab and spiny lobster. The Florida Bay Stock has the potential to interact with the Category II Florida spiny lobster trap/pot and Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot fisheries and the Category III Atlantic commercial passenger fishing vessel (hook and line) fishery. ~~There are no documented mortalities of bottlenose dolphins in crab or lobster pot fisheries in Florida Bay between 2003 and 2007.~~

Crab and Lobster Pots

There are no documented mortalities or serious injuries of bottlenose dolphins in crab or lobster pot fisheries in Florida Bay between 2007 and 2011. During 2003~~-2007~~, 1 bottlenose dolphin was reported entangled in a lobster pot in the southern, FKNMS portion of Florida Bay. ~~and was released alive (condition unknown).~~ The animal was disentangled and released alive, but due to its condition had to be taken shortly thereafter to rehab. It was re-released 2 weeks later. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab and lobster pots.

Hook and Line Fishery

During 2007-2011, there was 1 at-sea observation (in 2011) of a bottlenose dolphin entangled in monofilament line which was cutting off nearly half of its dorsal fin and trailing behind the animal. This animal was considered seriously injured (Maze-Foley and Garrison in prep.).

Other Mortality

~~From 2003 to 2007~~From 2007 to 2011, there were 5 ~~7 additional~~ stranded bottlenose dolphins within the boundaries of the Florida Bay ~~s~~Stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~10 November 2008~~13 September 2012). ~~Five of these animals stranded dead, but~~ Evidence of human interaction was found for 1 animal in the form of an old propeller scar. For the remaining 4 animals, it could not be determined if there was evidence of human interactions ~~for these cases~~. ~~One animal was initially observed alive and entangled in debris associated with Hurricane Wilma, and the animal died after being released. In addition, 1 animal confirmed to be from the Dolphin Ecology Project photo-ID catalog was observed out of habitat and was captured, relocated and released (Southeast Region Stranding Network).~~ The majority of stranding reports came from the portion of Florida Bay contained within the FKNMS, likely associated with the higher human population in this area. ~~Aside from the 1 animal, it is unknown if stranded animals were from the Florida Bay stock or drifted in from adjacent waters.~~ Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other fishery interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

Over the past several decades, large areas of the Everglades ecosystem have been significantly altered by engineered flood control and water distribution for urban and agricultural development. These alterations of freshwater flow into Florida Bay have resulted in increased algal blooms, mangrove and seagrass die-offs, trophic community shifts and changes in salinity. In response, multiple federal, state, county and local agencies are working on a Comprehensive Everglades Restoration Program with the objective of restoring the natural flows of water, water quality and more natural hydro-periods within the ecosystem. As one of the largest ecosystem restoration efforts in the United States, projects are on-going and will likely impact physical and biotic parameters in Florida Bay. While it is unknown how alterations in water flow historically affected bottlenose dolphin abundance and distribution, it is known that bottlenose dolphins are a good indicator species to monitor the future health of this ecosystem due to the overlap between dolphin foraging behavior and abundant fish populations (see Torres and Urban 2005).

There is some concern about the potential effect of contaminants on the health of bottlenose dolphins in Florida Bay, due to their proximity to large agricultural and industrial operations. Contaminants of concern include persistent organic pollutants and heavy metals such as mercury. The agricultural pesticide endosulfan is of particular concern, with the majority (76%) of endosulfan used in the southeast discharging into the Everglades and Florida Bay watershed (Pait *et al.* 1992). A study in 2003 collected remote biopsy samples and provided the first baseline

data on levels of exposure to toxic persistent organic contaminants for dolphins in Florida Bay. Pesticides such as endosulfan were found at low or non-detectable concentrations (Fair *et al.* 2003). A review of available organochlorine exposure data from both dart biopsy and live-capture health assessment studies along the southeast U.S. coast indicate that contaminant levels were lowest for dolphins sampled in Florida Bay when compared to all other sites in the southeast U.S. Measured concentrations of total DDTs were lowest for dolphins sampled in Florida Bay. Reported total PCB concentrations were also lowest in Florida Bay and this was the only location in the southeast where samples fell below the toxic threshold value for total PCBs (Schwacke *et al.* 2004). There are no estimates of indirect human-caused mortality from pollution or habitat degradation.

STATUS OF STOCK

~~From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).~~

Bottlenose dolphins in the western North Atlantic are not listed as threatened or endangered under the Endangered Species Act, and the Florida Bay Stock is not considered strategic under the ~~U.S. MMPA~~Marine Mammal Protection Act. There are no documented human-caused mortalities to this stock for 2007 – 2011. There are commercial crab and lobster trap/pot fisheries operating within the boundaries of this stock but the level of fishing effort is low and few animals strand with evidence of fishery interactions. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP is unknown. There are insufficient data to determine the population trends for this stock. ~~The status of the Florida Bay stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and the total fishery-related mortality and serious injury for this stock is unknown, but given the lack of stranded animals with evidence of fishery interactions and the low level of commercial fishery activity within the stock boundaries, it is likely to be less than 10% of PBR, and can be considered to be insignificant and approaching zero mortality and serious injury rate. Therefore, NMFS does not consider the Florida Bay stock of bottlenose dolphins to be strategic.~~

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COMMON BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Northern Gulf of Mexico Oceanic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Thirty-seven bottlenose dolphin stocks have been ~~provisionally identified for~~delimited in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) ~~bottlenose dolphins~~ (Waring *et al.* 2001). Northern Gulf of Mexico inshore habitats ~~has~~have been separated into 32 bay, sound and estuary~~estuarine~~ stocks. Three northern Gulf of Mexico coastal stocks inhabit coastal~~include nearshore~~ waters from the shore to the 20-m isobath. The northern Gulf of Mexico Continental Shelf Stock inhabits~~encompasses~~ waters from 20 to 200 m deep. The northern Gulf of Mexico Oceanic Stock inhabits~~encompasses~~ the waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ; Figure 1).

Both "coastal" and "offshore" ecotypes of common bottlenose dolphins (Mead and Potter 1995) occur in the Gulf of Mexico (Vollmer 2011), but the distribution of each is not well defined~~known~~. The offshore and coastal ecotypes are genetically distinct based on both mitochondrial and nuclear markers (Hoelzel *et al.* 1998; Vollmer 2011). In the northwestern Atlantic Ocean, Torres *et al.* (2003) found a statistically significant break in the distribution of the ecotypes at 34 km from shore. The offshore ecotype was found exclusively seaward of 34 km and in waters deeper than 34 m. The continental shelf is much wider in the Gulf of Mexico and these results may not apply. Ongoing research is aimed at better defining stock boundaries in coastal, continental shelf and oceanic waters of the Gulf of Mexico. Although the boundaries are not certain, the Oceanic Stock as currently defined is thought to be composed entirely of bottlenose dolphins of the offshore ecotype.

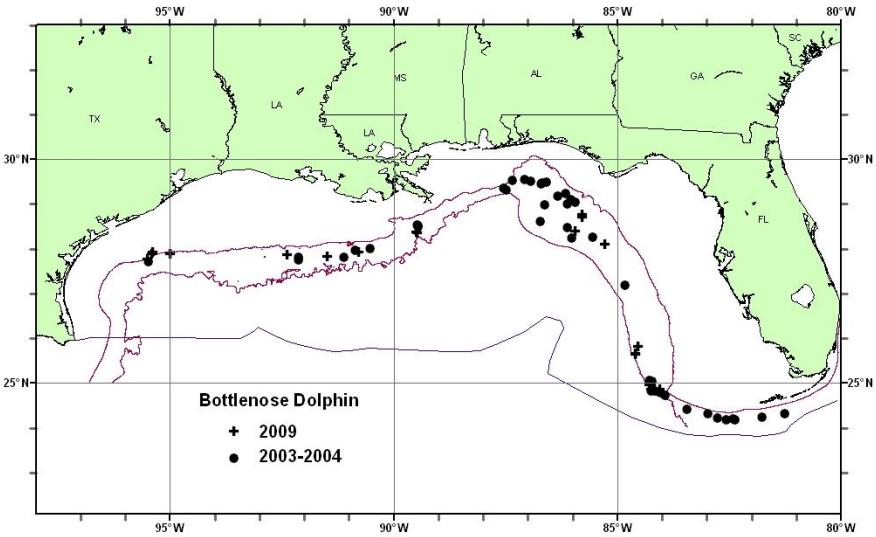

Figure 1. *Distribution of bottlenose dolphin sightings from SEFSC shipboard surveys during summer 2003 and spring 2004, and during summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the offshore extent of the U.S. EEZ.*

Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), bottlenose dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), ~~which is also composed of~~including waters belonging to Mexico and Cuba, where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.

The northern Gulf of Mexico Oceanic Stock of bottlenose dolphins is ~~provisionally~~ being considered separate from the Atlantic Ocean stocks of bottlenose dolphins for management purposes. One line of evidence to support this decision comes from Baron *et al.* (2008), who found that Gulf of Mexico bottlenose dolphin whistles (collected from oceanic waters) were significantly different from those in the western North Atlantic Ocean (collected from continental shelf and oceanic waters) in duration, number of inflection points and number of steps.

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Oceanic Stock of bottlenose dolphins is 5,806 (CV=0.39; Table 1). This estimate is from a summer 2009 oceanic survey covering waters from the 200 m isobath to the seaward extent of the U.S. EEZ.

Earlier abundance estimates

All estimates of abundance were derived through the application of distance sampling analysis (Buckland *et al.* 2001) and the computer program ~~DISTANCE~~Distance~~-~~Distance (Thomas *et al.* 1998) to line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200~~-~~m isobath to seaward extent of the U.S. EEZ) and are summarized in Appendix IV.

From 1996 to 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted ~~estimated~~ average abundance of bottlenose dolphins for all surveys combined was estimated. For 1996 to 2001, the estimate was 2,239 (CV=0.41) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for bottlenose dolphins, pooled from 2003 to 2004, was 3,708 (CV=0.42) (Mullin 2007; Table 1).

Recent survey and abundance estimate

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for bottlenose dolphins in oceanic waters during 2009 was 5,806 (CV=0.39; Table 1).

Table 1. Summary of abundance estimates for the northern Gulf of Mexico oceanic stock of bottlenose dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	2,239	0.41
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	3,708	0.42
Jun-Aug 2009	Oceanic waters	5,806	0.39

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for bottlenose dolphins is 5,806 (CV=0.39). The minimum population estimate for the northern Gulf of Mexico oceanic stock is 4,230 bottlenose dolphins.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007). Three point estimates of oceanic bottlenose dolphin abundance have been made based on data from surveys covering 1996-2009. The estimates vary by a maximum factor of more than two. ~~To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates.~~ Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of oceanic bottlenose dolphin abundance. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum productivity rates are unknown for this stock. For purposes of this assessment, the maximum productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 4,230. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the Gulf of Mexico oceanic bottlenose dolphin is 42.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury to this stock during ~~2006-2010 was 0.6~~2007-2011 was 3.1 bottlenose dolphins (CV=~~1.0~~0.82; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fisheries ~~which~~that could potentially ~~could~~ interact with this stock in the Gulf of Mexico are the Category I Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery and the Atlantic Highly Migratory Species (high seas longline) fishery. ~~and t~~The Category III Gulf of Mexico butterfish trawl fishery may also interact with this stock (Appendix III). ~~The level of past or current, direct, human-caused mortality of bottlenose dolphins in the Gulf of Mexico is unknown; however, interactions between bottlenose dolphins and fisheries have been observed in the Gulf of Mexico.~~

Pelagic swordfish, tunas and billfish are the targets of the pelagic longline fishery operating in the northern Gulf of Mexico. One bottlenose dolphin serious injury was observed in the pelagic longline fishery in 1998, and estimated serious injuries attributable to the pelagic longline fishery in the Gulf of Mexico region during quarter 1 of that year were 22 (CV=1.00; Yeung 1999). There were no reports of mortality or serious injury to bottlenose dolphins by this fishery in the northern Gulf of Mexico during 1999-2008 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009). However, during 2009, 1 serious injury of a bottlenose dolphin was observed during the second quarter and estimated serious injuries attributable to the pelagic longline fishery in the Gulf of Mexico region during quarter 2 were 3.1 (CV=1.00; Garrison and Stokes 2010). The total estimated serious injury for 2009 was 3.1 animals (CV=1.0). During 2010, 1 serious injury was observed in the second quarter during experimental fishing to test the effectiveness of "weak" hooks as a potential bycatch mitigation tool. There was 100% observer coverage of all experimental sets, and the experimental fishing is not included in extrapolated bycatch estimates because it is not representative of the normal fishing effort (Garrison and Stokes 2012a~~1~~). During 2011, 1 serious injury of a bottlenose dolphin was observed during the fourth quarter and estimated serious injuries attributable to the pelagic longline fishery in the Gulf of Mexico region during quarter 4 were 12.2 (CV=1.00; Garrison and Stokes 2012b). The annual average serious injury and mortality attributable to the Gulf of Mexico pelagic longline fishery for the 5-year period from ~~2006 to 2010 was 0.6~~2007 to 2011 was 3.1 animals (CV=~~1.0~~0.82; Table 2). During 2007, 1 bottlenose dolphin was observed entangled and released alive in the northern Gulf of Mexico. All longline gear was removed and the animal was presumed to have no serious injuries.

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980's with no records of incidental take of marine mammals (Burn and Scott 1988; NMFS unpublished data), although an experimental set by NMFS resulted in the death of 2 bottlenose dolphins (Burn and Scott 1988). There are no other data available

with regard to this fishery.

~~Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico oceanic bottlenose dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).~~

~~Fishery~~	~~Years~~	~~Vessels[a]~~	~~Data Type[b]~~	~~Observer Coverage~~	~~Observed Serious Injury~~	~~Observed Mortality~~	~~Estimated Serious Injury~~	~~Estimated Mortality~~	~~Estimated Combined Mortality~~	~~Est. CVs~~	~~Mean Annual Mortality~~
~~Pelagic Longline~~	~~06-10~~	~~47, 55, 53, 47, 46~~	~~Obs. Data Logbook~~	~~.08, .14, .25, .21, .26~~	~~0,0,0,1,0~~	~~0,0,0,0,0~~	~~0,0,0,3.2,0~~	~~0,0,0,0,0~~	~~0,0,0,3.2,0~~	~~NA, NA, NA,1.0, NA~~	~~0.6 (1.0)~~
~~TOTAL~~											~~0.6 (1.0)~~

~~a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.~~
~~b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.~~

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico oceanic bottlenose dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels[a]	Data Type[b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	07-11	55, 53, 47, 46, 42	Obs. Data Logbook	.15, .26, .22, .28, .18	0,0,1,0,1	0,0,0,0,0	0,0,3.1,0, 12.2	0,0,0,0,0	0,0,3.1,0, 12.2	NA, NA,1.0, NA,1.0	3.1 (0.82)
TOTAL											3.1 (0.82)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.

Other Mortality

A total of 1,564~~1,340~~ bottlenose dolphins were found stranded in the northern Gulf of Mexico from 2007~~2006~~ through 2011~~2010~~ (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012~~16 November 2011~~). Of these, 123~~114~~ showed evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds). The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins belonged to the continental shelf or oceanic stocks and that they were among those strandings with evidence of human interactions. (Strandings do occur for other cetacean species whose primary range in the Gulf of Mexico is outer continental shelf or oceanic waters.)

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1

February 2010; and, as of early 2013~~2~~, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 221 bottlenose dolphins were considered to be part of the UME. The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins considered part of the UME belonged to the continental shelf or oceanic stocks.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500 m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al*. 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

The use of explosives to remove oil rigs in portions of the continental shelf in the western Gulf of Mexico has the potential to cause serious injury or mortality to marine mammals. These activities have been closely monitored by NMFS observers since 1987 (Gitschlag and Herczeg 1994). There have been no reports of either serious injury or mortality to bottlenose dolphins in the oceanic Gulf of Mexico associated with these activities (NMFS unpublished data).

STATUS OF STOCK

~~The status of bottlenose dolphins, relative to OSP, in the northern Gulf of Mexico oceanic waters is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this stock. Total human caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.~~Bottlenose dolphins are not listed under the endangered species act, and the northern Gulf of Mexico oceanic stock is not considered strategic under the U.S. MMPA. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of bottlenose dolphins, relative to OSP, in the northern Gulf of Mexico oceanic waters is unknown. There are insufficient data to determine ~~the~~ population trends for this stock.

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April 2013
~~April 2012~~

RISSO'S DOLPHIN (*Grampus griseus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphins are~~is~~ distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves 1983). Risso's dolphins in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) occur throughout oceanic waters but are concentrated in continental slope waters (Figure 1; Baumgartner 1997; Maze-Foley and Mullin 2006). Risso's dolphins were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), Risso's dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), ~~which is also composed of~~ including waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

The Gulf of Mexico population is ~~provisionally~~ being considered a separate stock for management purposes, although there is currently little information to differentiate this stock from the Atlantic Ocean stock~~(s)~~. In 2006, a Risso's dolphin that stranded on the Florida Gulf Coast was rehabilitated, ~~satellite~~ tagged with a satellite-linked transmitter and released into the Gulf southwest of Tampa Bay. Over a 23-day period the Risso's dolphin moved from the Gulf release site into the Atlantic Ocean and north to just off of Delaware (Wells *et al.* 2009). During September 2007 – January 2008, tracking of an adult female Risso's dolphin that had been rehabilitated and released by Mote Marine Laboratory after stranding on the southwest coast of Florida documented movements throughout the northern Gulf of Mexico. The dolphin, released with its young calf, traveled as far as Bahia de Campeche, Mexico, and waters off Texas and Louisiana before returning to the shelf edge southwest of its stranding site off Florida (Wells *et al.* 2008a). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

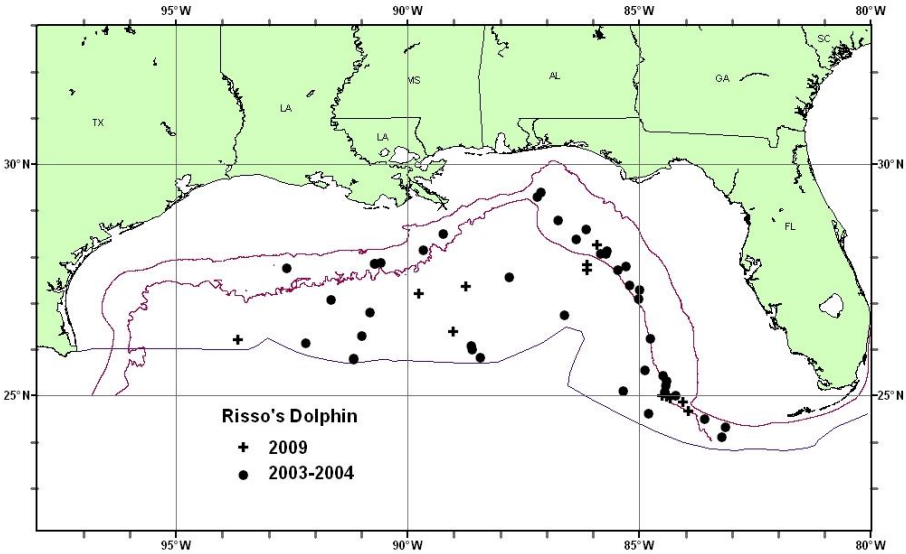

Figure 1. *Distribution of Risso's dolphin sightings from SEFSC vessel surveys during summer 2003 and spring 2004, and during summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100-m and 1,000-m isobaths and the offshore extent of the U.S. EEZ.*

POPULATION SIZE

The best abundance estimate available for northern Gulf of Mexico Risso's dolphins is 2,442 (CV=0.57; Table 1). This estimate is from a summer 2009 oceanic survey covering waters from the 200-m isobath to the seaward extent of the U.S. EEZ.

Earlier abundance estimates

All estimates of abundance were derived through the application of distance sampling analysis (Buckland *et al.* 2001) and the computer program ~~DISTANCE~~Distance (Thomas *et al.* 1998) to line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200-m isobath to seaward extent of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted ~~estimated~~ average abundance of Risso's dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 2,749 (CV=0.27) (Hansen *et al.* 1995), and for 1996 to 2001, 2,169 (CV=0.32) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for Risso's dolphins, pooled from 2003 to 2004, was 1,589 (CV=0.27) (Mullin 2007; Table 1).

Recent survey and abundance estimate

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for Risso's dolphins in oceanic waters during 2009 was 2,442 (CV=0.57; Table 1).

Table 1. Summary of abundance estimate for northern Gulf of Mexico Risso's dolphins. Month, year and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Apr-Jun 1991-1994	Oceanic waters	2,749	0.27
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	2,169	0.32
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	1,589	0.27
Jun-Aug 2009	Oceanic waters	2,442	0.57

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Risso's dolphins is 2,442 (CV=0.57). The minimum population estimate for the northern Gulf of Mexico is 1,563 Risso's dolphins.

Current Population Trend

A trend analysis has not been conducted for this stock. The statistical power to detect a trend in abundance for this stock is poor due to the relatively imprecise abundance estimates and long survey interval. For example, the power to detect a precipitous decline in abundance (i.e., 50% decrease in 15 years) with estimates of low precision (e.g., CV > 0.30) remains below 80% (alpha = 0.30) unless surveys are conducted on an annual basis (Taylor *et al.* 2007). Four point estimates of Risso's dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly two. ~~To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates.~~ Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of Risso's dolphin abundance. The 2 cases of satellite-linked tracking of Risso's dolphins in the Gulf of Mexico both showed movements out of the U.S. Gulf of Mexico EEZ (Wells *et al.* 2008a, 2009). The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one half the maximum net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum

population size is 1,563. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico Risso's dolphin is 16.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury for this stock during ~~2006-2010 is 1.7~~2007-2011 is 2.0 Risso's dolphins (CV=0.55~~63~~; Table 2).

New Serious Injury Guidelines

NMFS updated its serious injury designation and reporting process, which uses guidance from previous serious injury workshops, expert opinion, and analysis of historic injury cases to develop new criteria for distinguishing serious from non-serious injury (Angliss and DeMaster 1998; Andersen *et al*. 2008; NOAA 2012). NMFS defines serious injury as an "*injury that is more likely than not to result in mortality*". Injury determinations for stock assessments revised in 2013 or later incorporate the new serious injury guidelines, based on the most recent 5-year period for which data are available.

Fisheries Information

The commercial fishery ~~which~~that could potentially ~~could~~ interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to Risso's dolphins in the northern Gulf of Mexico by this fishery during 1998-2007 or during 2009-2010 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison and Stokes 2010; 2012a~~1~~). Between 2007~~6~~ and 2011~~0~~, 1 mortality and ~~2~~3 serious injuries of Risso's dolphins were observed during interactions with the pelagic longline fishery. These interactions occurred during the first and second quarters of 2008 and during the second quarter of 2011 (Table 2; Garrison *et al.* 2009; Garrison and Stokes 2010; Garrison and Stokes 2012a,b~~1~~). For the 5-year period, the estimated annual combined serious injury and mortality attributable to the pelagic longline fishery in the northern Gulf of Mexico was ~~1.7 (CV=0.63)~~2.0 (CV=0.55). During 15 April – 15 June, in 2008-2011~~0~~, observer coverage in the Gulf of Mexico was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. Resulting observer coverage for this time and area is very high (approaching 55%). Therefore, the high observer coverage during 2008-2011~~0~~ primarily reflects high coverage rates during the second quarter of the year. During 2011, 1 Risso's dolphin was observed entangled and released alive in the northern Gulf of Mexico. The animal was not hooked, but was entangled in mainline around its head and a flipper. All gear was removed and the animal immediately swam away and dove. During 2005, ~~1~~a Risso's dolphin was observed entangled and released alive in the northern Gulf of Mexico. The animal was not hooked, but was entangled with mainline and leader around its flukes. All gear was removed and the animal dove immediately. Both animals were~~It is~~ presumed to have not been seriously injured (Fairfield Walsh and Garrison 2006; Garrison and Stokes 2012b). There is a high likelihood that releases of dolphins that have ingested gear or with multi-wrap entanglements of appendages near their insertions will lead to mortality (Wells *et al.* 2008b).

~~Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico Risso's dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).~~

~~Fishery~~	~~Years~~	~~Vessels[a]~~	~~Data Type[b]~~	~~Observer Coverage~~	~~Observed Serious Injury~~	~~Observed Mortality~~	~~Estimated Serious Injury~~	~~Estimated Mortality~~	~~Estimated Combined Mortality~~	~~Est. CVs~~	~~Mean Annual Mortality~~

~~Pelagic Longline~~	~~06-10~~	~~47, 55, 53, 47, 46~~	~~Obs. Data Logbook~~	~~.08, .14, .25, .21, .26~~	~~0,0,2,0,0~~	~~0,0,1,0,0~~	~~0,0,3.9,0,0~~	~~0,0,4.4,0,0~~	~~0,0,8.3,0,0~~	~~NA,NA,.63,NA,NA~~	~~1.7 (0.63)~~
~~TOTAL~~											~~1.7 (0.63)~~

~~a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.~~
~~b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.~~

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico Risso's dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels [a]	Data Type [b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	07-11	55, 53, 47, 46, 42	Obs. Data Logbook	.15, .26, .22, .28, .18	0,2,0,0,1	0,1,0,0,0	0,3.9,0,0, 1.5	0,4.4,0,0, 0	0,8.3,0,0, 1.5	NA,.63, NA,NA, 1.0	2.0 (0.55)
TOTAL											2.0 (0.55)

[a] Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
[b] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.

Other Mortality

There were 11~~10~~ reported strandings of Risso's dolphins in the Gulf of Mexico during ~~2006-2010~~2007-2011 (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 13 September 2012~~16 November 2011~~). This includes one mass stranding of 4 animals in Florida during May 2007 (2 were rehabilitated and released by Mote Marine Laboratory) and one mass stranding of 2 animals in Florida during January 2009. No evidence of human interactions was detected for 3~~2~~ of the stranded animals, and it could not be determined if there was evidence of human interactions for the remaining 8 stranded animals. Stranding data probably underestimate the extent of ~~fishery~~human-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in ~~fishery~~human interactions wash ashore, not all that wash ashore are discovered, reported or investigated, nor will all of those that do wash ashore necessarily show signs of entanglement or other ~~fishery~~human interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interactions.

Since 1990, there have been 12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 1 of these included a Risso's dolphin. Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *Karenia brevis* blooms and fish kills in the Florida Panhandle. Additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins. An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010~~;~~, and~~,~~ as of early 2013~~2~~, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010 and 2011, no animals from this stock were considered to be part of the UME.

~~Table 3. Risso's dolphin (*Grampus griseus*) strandings along the northern Gulf of Mexico coast, 2006-2010.~~

~~STATE~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~2010~~	~~TOTAL~~
~~Alabama~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Florida~~	~~0~~	~~6[a]~~	~~0~~	~~2[b]~~	~~0~~	~~8~~
~~Louisiana~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Mississippi~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~
~~Texas~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~
~~TOTAL~~	~~0~~	~~6~~	~~0~~	~~3~~	~~1~~	~~10~~

~~[a] Includes Florida mass stranding of 4 animals in May 2007~~
~~[b] Includes Florida mass stranding of 2 animals in January 2009~~

Table 3. Risso's dolphin (*Grampus griseus*) strandings along the northern Gulf of Mexico coast, 2007-2011.

STATE	**2007**	**2008**	**2009**	**2010**	**2011**	**TOTAL**
Alabama	0	0	0	0	0	0
Florida	6[a]	0	2[b]	0	1	9
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	1	0	1
Texas	0	0	1	0	0	1
TOTAL	6	0	3	1	1	11

[a] Includes Florida mass stranding of 4 animals in May 2007
[b] Includes Florida mass stranding of 2 animals in January 2009

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500 m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite-linked tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to

pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

STATUS OF STOCK

~~The status of Risso's dolphins in the northern Gulf of Mexico, relative to OSP, is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the t~~Risso's dolphins are not listed under the endangered species act, and the northern Gulf of Mexico stock is not considered strategic under the U.S. MMPA. Total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and therefore cannot be considered to be insignificant and approaching zero mortality and serious injury rate. ~~This is not a strategic stock because it is assumed that t~~The average annual human-related mortality and serious injury does not exceed PBR. The status of Risso's dolphins in the northern Gulf of Mexico, relative to OSP, is unknown. There are insufficient data to determine the population trends for this species.

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APPENDIX I: Estimated serious injury and mortality (SI&M) of Western North Atlantic marine mammals listed by U.S. observed fisheries. Marine mammal species with zero (0) observed SI&M are not shown in this table. (unk = unknown).

Category, Fishery, Species	Yrs. observed	observer coverage	Est. SI by Year (CV)	Est. Mortality by Year (CV)	Mean Annual Mortality (CV)	PBR
CATEGORY I						
Gillnet Fisheries: Northeast gillnet						
Harbor porpoise - after Take Reduction Plan	~~2006~~2007-~~2010~~2011	~~.04,~~ .07, .05, .04, .17, .19		~~514(.31),~~ 395(.38), 666 (.48), 591(.23), 387(.30),	511(.17)	706
Atlantic white sided dolphin	2007-2011~~2006-2010~~	~~.04,~~ .07, .05, .04, .17, .19	0, 5, 0, 4, 1	~~41(.71),~~ 0, ~~81(.57)~~76, 0, ~~66(1.0)~~62, 20	~~38~~34(.46)	304
Short-beaked common dolphin	2007-2011~~2006-2010~~	~~.04,~~ .07, .05, .04, .17, .19	0, 0, 0, 0, 0	~~20(1.05),~~ 11(0.94), 34(.77), 43(.77), 42 (.94), 64(.73)	~~30(.42)~~39 (.38)	1,125~~5 29~~
~~Bottlenose dolphin (offshore)~~	~~2002-2006~~	~~.02, .03, .06, .07, .04~~		~~0, 0, 0, unk, unk~~	~~unk~~	~~566~~
Harbor seal	2007-2011~~2006-2010~~	~~.04,~~ .07, .05, .04, .17, .19	0, 0, 0, 0, 0	~~87(.58),~~ 93 (.49), 243(.41), 516(.28), ~~461~~459(.~~30~~26), 380 (.21)	~~280(.17)~~33 8 (.14)	1,662~~u ndet.~~
Gray seal	2007-2011~~2006-2010~~	~~.04,~~ .07, .05, .04, .17, .19	0, 0, 0, 0, 0	~~248(.47), 889~~886(0.24), 618(.23), 1063(.26), 1,~~115~~155(.~~31~~28), 1550(.16)	~~794(.13)~~1,0 54 (.11)	unk
Harp seal	2007-2011~~2006-2010~~	~~.04,~~ .07, .05, .04, .17, .19	0, 0, 0, 0, 0,	~~65(.66),~~ 119(.35), 238(.38), 415(.27), 253(.62), 15(.52)	~~218(.20)~~20 8 (.21)	unk
Pilot whale	2007-2011	.07, .05, .04, .17, .19	0, 0, 0, 0, 0,	0, 0, 0, 0, 3	1 (.82)	
Gillnet Fisheries:US Mid-Atlantic gillnet						
Harbor porpoise - after Take Reduction Plan	2007-2011~~2006-2010~~	~~.04,~~ .06, .03, .03, 04, .02		~~511(.32),~~ 58(1.03), 350(.75), 201(.55), 257(.89)	275(.29)	706
~~Bottlenose dolphin (offshore)~~	~~2002-2006~~	~~.01, .01, .02, .03, .04~~		~~unk, 0, 0, unk, unk~~	~~unk~~	~~566~~
Short-beaked common dolphin	2007-2011~~2006-2010~~	~~.04,~~ .06, .03, .03, 04, .02	0, 0, 0, 0, 0	~~11(1.03),~~ 0, 0, 0, ~~31~~30(.~~65~~48), 29(.53)	~~8.4(.55)~~12 (.36)	1,125~~5 29~~
Risso's dolphin	2007-2011~~2006-2010~~	~~.04,~~ .06, .03, .03, 04, .02	0, 0, 0, 0, 0	~~0,~~ 34(.73), 0, 0, 0, 0	6.8(.73)	126~~95~~
Harbor seal	2007-2011~~2006-2010~~	~~.04,~~ .06, .03, .03, 04, .02	0, 0, 0, 0, 0	~~26 (.98),~~ 0, 88(.74), 47(.68), ~~88~~89(.41), 21 (.67)	~~50~~49(.34)	1,662~~u ndet.~~

Harp Seal	2007-2011~~2006-2010~~	~~.04,~~ .06, .03, .03, 04, .02	0, 0, 0, 0, 0	~~0,~~ 38(.9), 176(.74), 70(.67), 32(.93), 0	63(.46)	unk
Gray Seal	2007-2011~~2006-2010~~	~~.04,~~ .06, .03, .03, 04, .02	0, 0, 0, 0, 0	0, 0, 0, 0, 265(.76), 19(.60)	~~53(.76)~~57 (.71)	unk
Longline Fisheries: Pelagic longline (excluding NED-E)						
Risso's dolphin	2007-2011~~2006-2010~~	~~.07,~~ .07, .07, .10, .08, .09	~~0,~~ 9 (.65), 17(.73), 11(.71), 0, 12(.63)	0, 0, 0, 0, 0	~~7.4(.71)~~10 (.36)	126~~95~~
~~Long and s~~Short-finned pilot whale [a]	2007-2011~~2006-2010~~	~~.07,~~ .07, .07, .10, .08, .09	~~212(.21), 169(.50),~~ 57(.65), 98(.42), 17(.70), 127(.78), 280(.29)	~~0, 16 (1.0),~~ 0, 0, 0, 0, 0	~~114 (.20)~~119 (.24)	~~172/93[e]~~ 159
Short-beaked ~~Common~~ common dolphin	2007-2011~~2006-2010~~	~~.07,~~ .07, .07, .10, .08, .09	0, 0, 0, 0, 0	~~0,~~ 0, 0, 8.5(1.0), 0, 0	1.7(1.0)	~~529~~1,125
Bottlenose dolphin (offshore)	2007-2011	.07, .07, .10, .08, .09	0, 0, 0, 8.5, 0	0, 0, 0, 0, 0	1.7 (1.0)	561
CATEGORY II						
Mid-Atlantic Mid-Water Trawl – Including Pair Trawl						
Risso's dolphin	2007-2011~~2006-2010~~	~~.089,~~ .039, .13, .13, .25, .41	0, 0, 0, 0, 0	~~0,~~ 0, 0.2 (unexpanded), 0, 0, 0	0.2	~~95~~126
White-sided dolphin	2007-2011~~2006-2010~~	~~.089,~~ .039, .13, .13, .25, .41	0, 0, 0, 0, 0	~~29(.74),~~ 12(.98), 15(.73), 4.3(.92), 0, 0	~~12(0.45~~6 (.53)	304
Short-beaked common dolphin	2007-2011~~2006-2010~~	~~.089,~~ .039, .13, .13, .25, .41	0, 0, 0, 0, 0	~~0,~~ 3.2(.70), 0, 0, 0, 0	0.6 (.70)	1,125~~5 29~~
Long and short-finned pilot whale	2007-2011~~2006-2010~~	~~.089,~~ .039, .13, .13, .25, .41	0, 0, 0, 0, 0	~~0, 0,~~ 12 (.99), 0, 0, 0, 0	2.4(.99)	159/199[c]~~172/93[e]~~
Gray Seal	2007-2011~~2006-2010~~	~~.089,~~ .039, .13, .13, .25, .41	0, 0, 0, 0, 0	0, 0, 0, 0, unk, 0	~~unk~~0.2	unk
Harbor seal	2007-2011	.039, .13, .13, .25, .41	0, 0, 0, 0, 0	0, 0, 0, 0.2 (unexpanded), 0	0.2	1,662
Trawl Fisheries:Northeast bottom trawl						
Harp seal	2007-2011~~2006-2010~~	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 0, 0	~~unk, 0,~~ 0, 0, unk, 0, unk	unk	unk
Harbor seal	2006-2010	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 0, 0	unk, 0, unk, ~~0,~~ unk, ~~0~~unk	0.8	1,662.~~undet.~~
Gray Seal	2007-2011~~v~~	~~.06,~~ .06, .08, .09, .16	0, 0, 0, 0, 0	~~0,~~ unk, unk, unk, unk, unk	~~unk~~9.2	unk
Long and short-finned pilot whale [a]	2007-	~~.12, .06,~~ .06, .08,	~~0, 0, 0, 0, 0~~na	~~15(.30), 14(.28),~~ 12 (.35), 10(.34),	~~12(0.14)~~10	172/93[c]

	2011~~2005-2009~~	.09, .16, .26		8.6(.35), 9 (.35,) unk	(.18)	
Short-beaked common dolphin	2007-2011~~2006-2010~~	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, ~~0~~na, 0	~~25(.28),~~ 24(.28), 17(.29), 19(.30), 17(.28), unk	~~20~~ 19 (.13)	1,125~~5 29~~
Atlantic white-sided dolphin	2007-2011~~2006-2010~~	~~.06,~~ .06, .08, .09, .16, .26	~~0, 0, 0, 0, 0~~1, 0, 3, 1, 3	~~164(.34), 147(.35), 147(.32), 131(.26), 119(.39)~~28, 17, 152, 43, 125	~~142~~73(.15)	304
Minke whale	2007-2011~~2006-2010~~	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 0, 0	~~3.7 (.73),~~ 3.2(.72), 2.9(.73), 2.9(.75), 0, 0	~~2.6(.46)~~1.8 (.42)	162
Harbor porpoise	2007-2011~~2006-2010~~	~~.06,~~ .06, .08, .09, .16, .26	0, 0, 0, 0, 0	~~6.5(.49),~~ 5.6(.46), 5.3(.47), 5.1(.50), 0, unk	4.5(.~~30~~27)	706
Bottlenose dolphin (offshore)	2007-2011	.06, .08, .09, .16, .26	0, 0, 0, 0, 0	48,19,18,4,10	20(.52)	561
Risso's dolphin	2007-2011	.06, .08, .09, .16, .26	0, 0, 0, 0, 0	3, 2, 3, 2, 3	2.5 (.24)	126
Mid-Atlantic Bottom Trawl						
Atlantic white-sided dolphin	2007-2011~~2006-2010~~	~~.02,~~ .03, .03, .05, .06, .08	0, 0, 0, 0, 0	~~26(.25), 21(.24), 16(.18), 16(.16), 22(.14)~~2, 1, 5, 2, 8	~~20(.09)~~4 (.20)	304
Long and short-finned pilot whale [a]	2007-2011~~2005-2009~~	~~.03, .02,~~ .03, .03, .05, .06, .08	0, 0, 0, 0, 0	~~31(.31), 37(.34),~~ 36(.38), 24(.36). 23(.36), 22(.35), unk	~~30(.16)~~26 (.19)	~~172~~159 /~~93~~[e]199 [c]
Short-beaked common dolphin	2007-2011~~2006-2010~~	~~.02,~~ .03, .03, .05, .06, .08	0, 0, 0, 0, ~~0~~na	~~131(.28),~~ 66(.27), 108(.28), 104(.29), 104(.29), unk	~~103 (.13)~~96 (.14)	1,125~~5 29~~
Risso's Dolphin	2007-2011~~2006-2010~~	~~.02,~~ .03, .03, .05, .06, .08	0, 0, 0, 0, 0	~~0, 0, 0, 0, 3 (unexpanded)~~33, 39, 23, 54, 62	~~3~~42 (.29)	126~~95~~
Bottlenose dolphin (offshore)	2007-2011	.03, .03, .05, .06, .08	0, 0, 0, 0, 0	11,16,21,20,34	20 (.17)	561
Harbor seal	2007-2011	.03, .03, .05, .06, .08	0, 0, 0, 0, 0	0, 0, 0, na, 0	0.2	1,662
Northeast Mid-Water Trawl Including Pair Trawl						
Long and short-finned pilot whale	2007-2011~~2005-2009~~	~~.199, .031,~~ .08, .20, .42, .54, .41	0, 0, 0, 0,0	~~0, 0,~~ 0, 16(.61), 0, 0, unk	~~3.24~~(.61)	159/199[c]~~172/93~~[e]
Short-beaked common dolphin	2007-2011~~2006-2010~~	~~.031,~~ .08, .20, .42, .54, .41	0, 0, 0,0 ,0	~~0,~~ 0, 0, 0 ,~~na~~unk, 0	~~na~~unk	1,125~~5 29~~
Harbor seal	2007-2011~~2006-2010~~	~~.031,~~ .08, .20, .42, .54, .41	0, 0, 0,0 ,0	~~0,~~ 0, 0, 1.3 (.81), na, 0	0.7(.81)	1,662.~~u ndet.~~

NOTES:

a. As of 2010, the PBR for pilot whales has been split. Short-finned pilot whale PBR is ~~172~~ 159 and long-finned pilot whale is ~~93~~199.

Appendix II. Five-year average rates of confirmed human-caused mortality and serious injury (SI) involving baleen whale stocks along the Gulf of Mexico Coast, US East Coast, and Atlantic Canadian Provinces, (2007-2011) (prorated number of events attributed to entanglements or vessel collisions by year in parentheses).

Stock	Mean Annual Mortality	Entanglements			Vessel Collisions		
		Annual rate (US/Canadian/Unassigned)	Confirmed mortalities (2007, 2008, 2009, 2010, 2011)	Confirmed SI (2007, 2008, 2009, 2010, 2011)	Annual rate (US/Canadian/Unassigned)	Confirmed mortalities (2007, 2008, 2009, 2010, 2011)	Confirmed SI (2007, 2008, 2009, 2010, 2011)
Western North Atlantic right whale (*Eubalaena glacialis*)	4.05	3.25 (0.2, 0, 3.05)	(1, 0, 0, 2, 1)	(0, 1, 3.75, 2, 5.5)	.8 (0.6, 0, 0.2)	(0, 0, 0, 1, 1)	(0, 0, 0, 0, 2)
Gulf of Maine humpback whale (*Megaptera novaeangliae*)	11.2	9.2 (1.85, 0.55, 6.80)	(1, 2, 2, 3, 0)	(4.25, 7.75, 6.75, 9.25, 8.5)	2 (2, 0, 0)	(3, 1, 0, 3, 2)	(0, 0, 0, 0, 1)
Western North Atlantic fin whale (*Balaenoptera physalus*)	3.7	2.3 (0.4, 0.6, 1.3)	(2, 0, 0, 0, 3)	(2.5, 0, 2.25, 0, 1)	1.4 (1.4, 0, 0)	(2, 1, 1, 2, 1)	(0, 0, 0, 0, 0)
Western North Atlantic sei whale (*B. borealis*)	1	.4 (0, 0.2, 0.2)	(0, 1, 0, 0, 0)	(0, 1, 0, 0, 0)	.6 (0.6, 0, 0)	(1, 0, 1, 0, 1)	(0, 0, 0, 0, 0)
Canadian East Coast minke whale (*B. acutorostrata*)	6.05	5.05 (1.2, 1.75, 2.1)	(1, 4, 0, 0, 4)	(3.25, 4.5, 3.5, 1, 3)	1 (1, 0, 0)	(0, 0, 1, 1, 3)	(0, 0, 0, 0, 0)

Appendix III
Fishery Descriptions

This appendix is broken into two parts: Part A describes commercial fisheries that have documented interactions with marine mammals in the Atlantic Ocean; and Part B describes commercial fisheries that have documented interactions with marine mammals in the Gulf of Mexico. A complete list of all known fisheries for both oceanic regions, the 2012 List of Fisheries, is published in the *Federal Register*, (76 FR 73912;November 29, 2011).~~2011 List of Fisheries, is published in the *Federal Register*, (75 FR 68468, November 8, 2010).~~ Each part of this appendix contains three sections: I. data sources used to document marine mammal mortality/entanglements and commercial fishing effort trip locations, II. fishery descriptions for Category I, II and some category III fisheries that have documented interactions with marine mammals and their historical level of observer coverage, and III. historical fishery descriptions.

Part A. Description of U.S Atlantic Commercial Fisheries

I. Data Sources

Items 1-5 describe sources of marine mammal mortality, serious injury or entanglement data; items 6-~~8~~ 9 describe the sources of commercial fishing effort data used to summarize different components of each fishery (i.e. active number of permit holders, total effort, temporal and spatial distribution) and generate maps depicting the location and amount of fishing effort.

1. Northeast Region Fisheries Observer Program (NEFOP)

In 1989 a Fisheries Observer Program was implemented in the Northeast Region (Maine-Rhode Island) to document incidental bycatch of marine mammals in the Northeast Region Multi-species Gillnet Fishery. In 1993 sampling was expanded to observe bycatch of marine mammals in Gillnet Fisheries in the Mid-Atlantic Region (New York-North Carolina). The Northeast Fisheries Observer Program (NEFOP) has since been expanded to sample multiple gear types in both the Northeast and Mid-Atlantic Regions for documenting and monitoring interactions of marine mammals, sea turtles and finfish bycatch attributed to commercial fishing operations. At sea observers onboard commercial fishing vessels collect data on fishing operations, gear and vessel characteristics, kept and discarded catch composition, bycatch of protected species, animal biology, and habitat (NMFS-NEFSC 2003).

2. Southeast Region Fishery Observer Programs

Three Fishery Observer Programs are managed by the Southeast Fisheries Science Center (SEFSC) that observe commercial fishery activity in U.S. Atlantic waters. The Pelagic Longline Observer Program (POP) administers a mandatory observer program for the U.S. Atlantic Large Pelagics Longline Fishery. The program has been in place since 1992 and randomly allocates observer effort by eleven geographic fishing areas proportional to total reported effort in each area and quarter. Observer coverage levels are mandated under the Highly Migratory Species Fisheries Management Plan (HMS FMP, 50 CFR Part 635). The second program is the Shark Gillnet Observer Program that observes the Southeastern U.S. Atlantic Shark Gillnet Fishery. The Observer Program is mandated under the HMS FMP, the Atlantic Large Whale Take Reduction Plan (ALWTRP) (50 CFR Part 229.32), and the Biological Opinion under Section 7 of the Endangered Species Act. Observers are deployed on any active fishing vessel reporting shark drift gillnet effort. In 2005, this program also began to observe sink gillnet fishing for sharks along the southeastern U.S. coast. The observed fleet includes vessels with an active directed shark permit and fish with sink gillnet gear (Carlson and Bethea 2007). The third program is the Southeastern Shrimp Otter Trawl Fishery Observer Program. Prior to 2007, this was a voluntary program administered by SEFSC in cooperation with the Gulf and South Atlantic Fisheries Foundation. The program was funding and project dependent, therefore observer coverage is not necessarily randomly allocated across the fishery. In 2007, the observer program was expanded, and it became mandatory for fishing vessels to take an observer if selected. The program now includes more systematic sampling of the fleet based upon reported landings and effort patterns. The total level of observer coverage for this program is approximately 1% of the total fishery effort. In each Observer Program, the observers record information on the total target species catch, the number and type of interactions with protected species (including both marine mammals and sea turtles), and biological information on species caught.

3. Regional Marine Mammal Stranding Networks

The Northeast and Southeast Region Stranding Networks are components of the Marine Mammal Health and Stranding Response Program (MMHSRP). The goals of the MMHSRP are to facilitate collection and dissemination of data, assess health trends in marine mammals, correlate health with other biological and environmental parameters, and coordinate effective responses to unusual mortality events (Becker *et al.* 1994). Since 1997, the Northeast Region Marine Mammal Stranding Network has been collecting and storing data on marine mammal strandings and entanglements that occur from Maine through Virginia.~~.~~ The Southeast Region Strandings Program is responsible for data collection and stranding response coordination along the Atlantic coast from North Carolina to Florida, along the U.S. Gulf of Mexico coast from Florida through Texas, and in the U.S. Virgin Islands and Puerto Rico. Prior to 1997, stranding and entanglement data were maintained by the New England Aquarium and the National Museum of Natural History, Washington, D.C. Volunteer participants, acting under a letter of agreement, collect data on stranded animals that include: species; event date and location; details of the event (i.e., signs of human interaction) and determination on cause of death; animal disposition; morphology; and biological samples. Collected data are reported to the appropriate Regional Stranding Network Coordinator and are maintained in regional and national databases.

4. Marine Mammal Authorization Program

Commercial fishing vessels engaging in Category I or II fisheries are automatically registered~~required to register~~ under the Marine Mammal Authorization Program (MMAP) in order to lawfully take a~~takea~~ non-endangered/threatened marine mammal incidental to fishing operations. These fishermen are required to carry an Authorization Certificate onboard while participating in the listed fishery and must be prepared to carry a fisheries observer if selected. All vessel owners, regardless of the category of fishery they are operating in, are required to report, within 48 hours of the incident and even if an observer has recorded the take, all incidental injuries and mortalities of marine mammals that have occurred as a result of fishing operations (NMFS-OPR 2003). Events are reported by fishermen on the Marine Mammal Mortality/Injury forms then submitted to and maintained by the NMFS Office of Protected Resources~~ within 48 hours of the incident even if an observer has recorded the take~~. The data reported include: captain and vessel demographics; gear type and target species; date, time and location of event; type of interaction; animal species; mortality or injury code; and number of interactions. Reporting forms are available online at http://www.nmfs.noaa.gov/pr/pdfs/interactions/mmap_reporting_form.pdf.~~ Reporting forms are available online at www.nero.noaa.gov/mmap.~~

5. Other Data Sources for Protected Species Interactions/Entanglements/Ship Strikes

In addition to the above, data on fishery interactions/entanglements and vessel collisions with large cetaceans are reported from a variety of other sources including the New England Aquarium (Boston, Massachusetts); Provincetown Center for Coastal Studies (Provincetown, Massachusetts); U.S. Coast Guard; whale watch vessels; Canadian Department of Fisheries and Oceans (DFO));~~););~~ and members of the Atlantic Large Whale Disentanglement Network.~~.~~ These data, photographs, etc. are maintained by the Protected Species Division at the Northeast Regional Office (NERO), the Protected Species Branch at the Northeast Fisheries Science Center (NEFSC) and the Southeast Fisheries Science Center (SEFSC).~~SEFSC.~~

6. Northeast Region Vessel Trip Reports

The Northeast Region Vessel Trip Report Data Collection System is a mandatory, but self-reported, commercial fishing effort database (Wigley *et al.* 1998). The data collected include: species kept and discarded; gear types used; trip location; trip departure and landing dates; port; and vessel and gear characteristics. The reporting of these data is mandatory only for vessels fishing under a federal permit. Vessels fishing under a federal permit are required to report in the Vessel Trip Report even when they are fishing within state waters.

7. Southeast Region Fisheries Logbook System

The Fisheries Logbook System (FLS) is maintained at the SEFSC and manages data submitted from mandatory Fishing Vessel Logbook Programs under several FMPs. In 1986 a comprehensive logbook program was initiated for the Large Pelagics Longline Fishery and this reporting became mandatory in 1992. Logbook reporting has also been initiated since the early 1990s for a number of other fisheries including: Reef Fish Fisheries; Snapper-Grouper Complex Fisheries; federally managed Shark Fisheries; and King and Spanish Mackerel Fisheries. In each case, vessel captains are required to submit information on the fishing location, the amount and type of fishing gear used, the total amount of fishing effort (e.g., gear sets) during a given trip, the total weight and composition of the catch, and the disposition of the catch during each unit of effort (e.g., kept, released alive, released dead). FLS data are

used to estimate the total amount of fishing effort in the fishery and thus expand bycatch rate estimates from observer data to estimates of the total incidental take of marine mammal species in a given fishery.

8. Northeast Region Dealer Reported Data

The Northeast Region Dealer Database houses trip level fishery statistics on fish species landed by market category, vessel ID, permit number, port location and date of landing, and gear type utilized. The data are collected by both federally permitted seafood dealers and NMFS port agents. Data are considered to represent a census of both vessels actively fishing with a federal permit and total fish landings. It also includes vessels that fish with a state permit (excluding the state of North Carolina) that land a federally managed species. Some states submit the same trip level data to the Northeast Region, but contrary to the data submitted by federally permitted seafood dealers, the trip level data reported by individual states does not include unique vessel and permit information. Therefore, the estimated number of active permit holders reported within this appendix should be considered a minimum estimate. It is important to note that dealers were previously required to report weekly in a dealer call in system. However, in recent years the NER regional dealer reporting system has instituted a daily electronic reporting system. Although the initial reports generated from this new system did experience some initial reporting problems, these problems have been addressed and the new daily electronic reporting system is providing better real time information to managers.

9. Northeast At Sea Monitoring Program

At-sea monitors collect scientific, management, compliance, and other fisheries data onboard commercial fishing vessels through interviews of vessel captains and crew, observations of fishing operations, photographing catch, and measurements of selected portions of the catch and fishing gear. At-sea monitoring requirements are detailed under Amendment 16 to the NE Multispecies Fishery Management Plan with a planned implementation date of May 1st, 2010. At-sea monitoring coverage is an integral part of catch monitoring to ensure that Annual Catch Limits are not exceeded. At-sea monitors collect accurate information on catch composition and the data are used to estimate total discards by sectors (and common pool), gear type, and stock area. Coverage levels are expected around 30%.

II. Marine Mammal Protection Act's List of Fisheries

The List of Fisheries (LOF) classifies U.S. commercial fisheries into one of three Categories according to the level of incidental mortality or serious injury of marine mammals:

I. frequent incidental mortality or serious injury of marine mammals
II. occasional incidental mortality or serious injury of marine mammals
III. remote likelihood of/no known incidental mortality or serious injury of marine mammals

The Marine Mammal Protection Act (MMPA) mandates that each fishery be classified by the level of serious injury and mortality of marine mammals that occurs incidental to each fishery as reported in the annual Marine Mammal Stock Assessment Reports for each stock. A fishery may qualify as one Category for one marine mammal stock and another Category for a different marine mammal stock. A fishery is typically categorized on the LOF according to its highest level of classification (e.g., a fishery that qualifies for Category III for one marine mammal stock and Category II for another marine mammal stock will be listed under Category II). The classifications listed below are based on the Final 2012 LOF published in the Federal Register (76 FR 73912; November 29, 2011)

III. U.S Atlantic Commercial Fisheries

Northeast Sink Gillnet ~~**(text includes descriptions of Northeast anchored float and Northeast drift gillnets)**~~

Current category: Category I

Basis for current classification on the LOF: The annual mortality and serious injury to harbor porpoises (Gulf of Maine/Bay of Fundy [GME/BF] stock), humpback whales (Gulf of Maine stock), minke whales (Canadian East Coast stock), and North Atlantic right whales (Western North Atlantic [WNA] stock) in this fishery exceeds 50% of each stock's Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Fin whale, WNA; Gray seal, WNA; Harbor porpoise, GME/BF(1); Harbor seal, WNA; Harp seal, WNA; Hooded seal, WNA; Humpback whale, GME; Minke whale, Canadian East Coast; North Atlantic right whale, WNA; Risso's dolphin, WNA; White-sided dolphin, WNA. Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: This fishery uses sink gillnet gear, which is anchored gillnet (bottom tending net) fished in the lower one-third of the water column. The dominant material is monofilament twine with stretched mesh sizes from 6-12 in (15-30.5 cm) and string lengths from 600-10,500 ft (183-3,200 m), depending on the target species. The mesh size and string length vary by the primary fish species targeted for catch.

Target species: Atlantic cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, windowpane flounder, spiny dogfish, monkfish, silver hake, red hake, white hake, ocean pout, skate spp, mackerel, redfish, and shad.

Spatial/temporal distribution of effort: The fishery operates from the U.S.-Canada border to Long Island, New York, at 72° 30'W. long. south to 36° 33.03'N. lat. (corresponding with the Virginia-North Carolina border) and east to the eastern edge of the Exclusive Economic Zone (EEZ), including the Gulf of Maine, Georges Bank, and Southern New England, and excluding Long Island Sound and other waters where gillnet fisheries are listed as Category II and III. -At this time, these Category II and III fisheries include: -the Northeast anchored float gillnet; Northeast drift gillnet; Long Island Sound inshore gillnet; and RI, southern MA (to Monomoy Island), and NY Bight (Raritan and Lower NY Bays) inshore gillnet. -Fishing effort occurs year-round, peaking from May-July primarily on continental shelf regions in depths from 30-750 ft. (9-228.6 m), with some nets deeper than 800 ft. (244 m). Figures 1-5 document the distribution of sets and marine mammal interactions observed from ~~20062005~~2007 to ~~20102009~~2011, respectively.

Management and Regulations: This gear is addressed by several federal and state FMPs; the Atlantic Large Whale Take Reduction Plan (ALWTRP) and Harbor Porpoise Take Reduction Plan (HPTRP). These fisheries are primarily managed by total allowable catch (TACs); individual trip limits (i.e., quotas); effort caps (i.e., limited number of days at sea per vessel); time and area closures; and gear restrictions.

~~Target Species: Atlantic Cod, Haddock, Pollock, Yellowtail Flounder, Winter Flounder, Witch Flounder, American Plaice, Windowpane Flounder, Spiny Dogfish, Monkfish, Silver Hake, Red Hake, White Hake, Ocean Pout, and Skate spp.~~

~~Number of Permit Holders: In 2010~~2009, 1,~~266~~988 ~~federal northeast permit holders identified sink gillnet as a potential gear type.~~

~~Number of Active Permit Holders: In 2010, 233~~2009, 178 ~~federal northeast permit holders reported the use of sink gillnets in the Northeast Region Dealer Reported Landings Database.~~

Total Effort (includes descriptions of Northeast anchored float and Northeast drift gillnets): Total metric tons of fish landed from 1998 to 2010~~1~~2009 were 22,933, 18,681, 14,487, 14, 634, 15,201, 17,680, 19,080, 15.390, 14,950, 15,808, 18,808, ~~and~~ 17,207, ~~and~~ 18,170 and 19,279~~-~~ respectively (NMFS). Data on total quantity of gear fished (i.e., number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, and therefore will not be reported here.

~~Temporal and Spatial Distribution: Effort is distributed throughout the Gulf of Maine, Georges Bank, and Southern New England Regions. Effort occurs year-round with a peak during May, June, and July primarily on the continental shelf region in depths ranging from 30 to 750 feet. Some nets are set in water depths greater than 800 feet. Figures~~

~~1-5 document the distribution of sets and marine mammal interactions observed from 20062005 to 20102009, respectively.~~

~~Gear Characteristics: The Northeast Sink Gillnet Fishery is dominated by a bottom tending (sink) net. Less than 1% of the fishery utilizes a gillnet that either is anchored floating or drift (i.e. Northeast anchored float and Northeast drift gillnet fisheries). Monofilament is the dominant material used with stretched mesh sizes ranging from 6 to 12 inches. String lengths range from 600 to 10,500 feet long. The mesh size and string length vary by the primary fish species targeted for catch.~~

~~Management and Regulations: The Northeast Sink Gillnet Fishery ishas been defined as a Category I fishery, and both the Northeast anchored float and Northeast drift gillnet fisheries as Category II fisheries, in the 2012 List of Fisheries 76 FR 73912;November 29, 2011).2010 List of Fisheries (74 FR 58859, November 16, 2009, 50 CFR Part 229). This gear is addressed by several federal and state FMPs that range North and East of the 72 degree 30 min line; the Atlantic Large Whale Take Reduction Plan (ALWTRP) and Harbor Porpoise Take Reduction Plan (HPTRP). This fishery operates from the U.S./Canada border to Long Island, NY, at 72º 30' W long. south to 36º 33.03'N lat (corresponding with the Virginia-North Carolina border). and east to the eastern edge of the EEZ, excludingnot including Long Island Sound or other waters where gillnet fisheries are listed as Category II or III. The relevant FMPs include, but may not be limited to: the Northeast Multi-species (FR 67, CFR Part 648.80 through 648.97); Monkfish (FR 68(81), 50 CFR Part 648.91 through 648.97); Spiny Dogfish (FR 65(7), 50 CFR Part 648.230 through 648.237); Summer Flounder, Scup and Black Sea Bass (FR 68(1), 50 CFR part 648.100 through 648.147); Atlantic Bluefish (FR 68(91), 50 CFR Part 648.160 through 648.165); and Northeast Skate Complex (FR 68(160), 50 CFR part 648.320 through 648.322). These fisheries are primarily managed by total allowable catch (TACs); individual trip limits (i.e., quotas); effort caps (i.e., limited number of days at sea per vessel); time and area closures; and gear restrictions.~~

Observer Coverage (includes descriptions of Northeast anchored float and Northeast drift gillnets): During the period 1990-2011, estimated percent observer coverage (number of trips observed/total commercial trips reported) was 1, 6, 7, 5, 7, 5, 4, 6, 5, 6, 6, 4, 2, 3, 6, 7, 4, 7, 5, 4, 17 and- 19 respectively.

~~During the period 1990-20102009, estimated percent observer coverage (number of trips observed/total commercial trips reported) was 1, 6, 7, 5, 7, 5, 4, 6, 5, 6, 6, 4, 2, 3, 6, 7, 4, 7, 5, 4 and 174 respectively.~~

Comments: Effort patterns in this fishery are heavily influenced by fish time/area closures, and gear restrictions due to fish conservation measures, time/area closures and gear restrictions under the ALWTRP, and seasonal pinger requirements and time/area closures under the HPTRP.

Northeast Anchored Float Gillnet Fishery

Current category: Category II
~~pinger requirements and time/area closures under the HPTRP.~~
Current list of marine mammal species/stocks injured/killed: Harbor seal, Western North Atlantic (WNA); Humpback whale, Gulf of Maine; White-sided dolphin, WNA.

Gear description/method for fishing: This fishery uses gillnet gear of any size anchored and fished in the upper two-thirds of the water column.

Target species: Mackerel, herring (particularly for bait), shad, and menhaden.

Spatial/temporal distribution of effort: —The fishery operates from the U.S.-Canada border to Long Island, New York, at 72° 30'W. long south to 36° 33.03'N. lat. (corresponding with the Virginia-North Carolina border) and east to the eastern edge of the EEZ, not including Long Island Sound or other waters where gillnet fisheries are listed as Category III.

Management and regulations: -The fishery is managed by the Atlantic States Marine Fisheries Commission [ASMFC] under the Interstate Fishery Management Plans (ISFMP) for Atlantic Menhaden and Shad and is subject to ALWTRP implementing regulations. –A total closure of the American shad ocean intercept fishery was fully implemented in January, 2005.

Total Effort (includes descriptions of Northeast anchored float and Northeast drift gillnets): Total metric tons of fish landed from 1998 to 2011 were 22,933, 18,681, 14,487, 14, 634, 15,201, 17,680, 19,080, 15.390, 14,950, 15,808, 18,808, 17,207, 18,170 and 19,279 respectively (NMFS). Data on total quantity of gear fished (i.e., number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, and therefore will not be reported here.

Observer Coverage (includes descriptions of Northeast anchored float and Northeast drift gillnets): During the period 1990-2011, estimated percent observer coverage (number of trips observed/total commercial trips reported) was 1, 6, 7, 5, 7, 5, 4, 6, 5, 6, 6, 4, 2, 3, 6, 7, 4, 7, 5, 4, 17 and- 19 respectively.

Comments: Effort patterns in this fishery are heavily influenced by fish time/area closures, and gear restrictions due to fish conservation measures, time/area closures and gear restrictions under the ALWTRP, and seasonal pinger requirements and time/area closures under the HPTRP.

Northeast Drift Gillnet Fishery

Current category: Category II

Basis of current classification on the LOF: Based on analogy to other Northeast gillnet fisheries that use similar gear and operate in a similar manner to this fishery.

Current list of marine mammal species/stocks injured/killed: None documented

Gear description/method for fishing: This fishery uses drift gillnet gear, which is gillnet gear not anchored to the bottom and is free-floating on both ends or free-flowing at one end and attached to the vessel at the other end. Mesh sizes are likely less than those used to target large pelagics.

Target species: This fishery targets species including shad, herring, mackerel, and menhaden and any residual large pelagic driftnet effort in New England.

Spatial/temporal distribution of effort: The fishery includes any residual large pelagic driftnet effort in New England and occurs at any depth in the water column from the U.S.-Canada border to Long Island, New York, at 72° 30'W. long. south to 36° 33.03'N. lat. (corresponding with the Virginia-North Carolina border) and east to the eastern edge of the Exclusive Economic Zone (EEZ).

Management and regulations: The fishery is managed under the Interstate Fishery Management Plans (ISFMPs) for Atlantic Menhaden and Shad (managed by the Atlantic States Marine Fisheries Commission [ASMFC]) and is subject to ALWTRP implementing regulations. A total closure of the American shad ocean intercept fishery was fully implemented in January, 2005.

Total Effort (includes descriptions of Northeast anchored float and Northeast drift gillnets): Total metric tons of fish landed from 1998 to 2011 were 22,933, 18,681, 14,487, 14, 634, 15,201, 17,680, 19,080, 15.390, 14,950, 15,808, 18,808, 17,207, 18,170 and 19,279 respectively (NMFS). Data on total quantity of gear fished (i.e., number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, and therefore will not be reported here.

Observer Coverage (includes descriptions of Northeast anchored float and Northeast drift gillnets): During the period 1990-2011, estimated percent observer coverage (number of trips observed/total commercial trips reported) was 1, 6, 7, 5, 7, 5, 4, 6, 5, 6, 6, 4, 2, 3, 6, 7, 4, 7, 5, 4, 17 and 19 respectively.

Comments: Effort patterns in this fishery are heavily influenced by fish time/area closures, and gear restrictions due to fish conservation measures, time/area closures and gear restrictions under the ALWTRP, and seasonal

~~Protected Species Interactions: Documented interaction with harbor porpoise, white-sided dolphin, harbor seal, gray seal, harp seal, hooded seal, long finned pilot whale, offshore bottlenose dolphin, Risso's dolphin, humpback~~

~~whale,minke whale, North Atlantic right whale and common dolphin were reported in this fishery. Not mentioned here are possible interactions with sea turtles and sea birds.~~

~~Bay of Fundy Sink Gillnet~~

~~Target Species: Atlantic cod and other groundfish.~~

~~Number of Permit Holders: To Be Determined~~

~~Number of Active Permit Holders: To Be Determined~~

~~Total Effort: To Be Determined~~

~~Temporal and Spatial Distribution: In Canadian waters the Gillnet Fishery occurs during the summer and early autumn months mostly in the western portion of the Bay of Fundy.~~

~~Gear Characteristics: Typical gillnet strings are 300 m long (three 100 m panels), 4 m deep, with stretched mesh size of 15 cm, strand diameter of 0.57-0.60 mm, and are usually set at a depth of about 100 m for 24 hours.~~

~~Management and Regulations: To Be Determined~~

~~Observer Coverage: During the period 1994 to 2001, the estimated percent observer coverage of the Grand Manan portion of the sink gillnet fishery was 49, 89, 80, 80, 24, 11, 41, and 56. The fishery was not observed during 2002 and 2003.~~

~~Comments: Marine mammals in Canadian waters are regulated by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). DFO Maritimes Region has developed a Harbour Porpoise Conservation Strategy that has set a maximum take of 110 Harbor Porpoise per year in the Bay of Fundy. Bycatch mitigation measures include acoustic pingers and nylon barium-sulphate netting that target cetacean and sea bird bycatch reduction goals, and fishery effort restrictions that target fish management goals.~~

~~Protected Species Interactions: Documented interactions with bottlenose dolphin, common dolphin, fin whale, gray seal, harbor porpoise, harbor seal, harp seal, hooded seal, humpback whale, minke whale, North Atlantic right whale, Risso's dolphin, white-sided dolphin and sea birds were reported in this fishery.~~

Mid-Atlantic Gillnet

Current category: Category I

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Southern Migratory coastal(1); Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Southern NC estuarine system (1) ; Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Gray seal, WNA; Harbor porpoise, Gulf of Maine/Bay of Fundy; Harbor seal, WNA; Harp seal, WNA; Humpback whale, Gulf of Maine; Long-finned pilot whale, WNA; Minke whale, Canadian East Coast; Short-finned pilot whale, WNA; White-sided dolphin, WNA. Not mentioned here are possible interactions with sea turtles and sea birds and interactions with large whale species in which the gear may not be identified to a specific area or gear. Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: This fishery uses drift and sink gillnets, including nets set in a sink, stab, set, strike, or drift fashion, with some unanchored drift or sink nets used to target specific species. The dominant material is monofilament twine with stretched mesh sizes from 2.5-12 in (6.4-30.5 cm), and string lengths from 150-8,400 ft. (46-2,560 m).

Target Species: Monkfish, Spiny and Smooth Dogfish, Bluefish, Weakfish, Menhaden, Spot, Croaker, Striped Bass, Coastal Sharks, Spanish Mackerel, King Mackerel, American Shad, Black Drum, Skate spp., Yellow perch, White

Perch, Herring, Scup, Kingfish, Spotted Seatrout, and Butterfish.

Temporal and Spatial Distribution: This fishery operates year-round, extending from New York to North Carolina, not including waters where Category II and III inshore gillnet fisheries operate in bays, sounds, estuaries, and rivers. It is comprised of a combination of small vessels that target a variety of fish species. This fishery includes any residual large pelagic driftnet effort in the mid-Atlantic, shark and dogfish gillnet effort in the mid-Atlantic, and those North Carolina small and large mesh beach-anchored gillnets formerly placed in the Category II Mid-Atlantic haul/ beach seine fishery in the mid-Atlantic zone described. For more details on construction of this gear specifically please refer to 2009 Proposed List of Fisheries, published in the *Federal Register*, (73 FR 73760; June 13, 2008). This fishery can be prosecuted right off the beach (6 feet) or in nearshore coastal waters to offshore waters (250 feet). The eastern boundary of this fishery is a line drawn at 72° 30' W long. from Long Island south to 36º 33.03' N lat., then east to the EEZ, and then south to the North Carolina/South Carolina border. The area does not include waters where Category II and III inshore gillnet fisheries operate in bays, estuaries, and rivers. Figures 6-10 document the distribution of sets and marine mammal interactions observed from 2007 to 2011, respectively.

Management and Regulations: Gear in this fishery is managed by several federal and interstate Fishery Management Plans by the Atlantic States Marine Fisheries Commission, ALWTRP, HPTRP, and BDTRP. Fisheries are primarily managed by total allowable catch limits; individual trip limits (quotas); effort caps (limited number of days at sea per vessel); time and area closures; and gear restrictions and modifications.

~~Number of Permit Holders: In 2010, 6402009, 637 federal mid-Atlantic permit holders identified sink gillnet as a potential gear type.~~

~~Number of Active Permit Holders: In 20102009, approximately 207137 federal mid-Atlantic permit holders reported the use of sink gillnets in the Northeast Region Dealer Reported Landings Database.~~

Total Effort: Total metric tons of fish landed from 1998 to 2010~~21009~~ were 15,494, 19,130, 16,333, 14,855, 13,389, 13,107, 15,124, 12, 994, 8,755, 9,359, 8,622, ~~and~~ 8,703, ~~and~~ 10,725 and 11,292 respectively (NMFS). Data on total quantity of gear fished (i.e. number of sets) have not been reported consistently among commercial gillnet fishermen on vessel logbooks, therefore will not be reported here.

~~Temporal and Spatial Distribution: This fishery operates year-round, extending from New York to North Carolina, not including waters where Category II and III inshore gillnet fisheries operate in bays, sounds, estuaries, and rivers.. It is comprised of a combination of small vessels that target a variety of fish species. This fishery includes any residual large pelagic driftnet effort in the mid-Atlantic, shark and dogfish gillnet effort in the mid-Atlantic, and those North Carolina small and large mesh beach-anchored gillnets formerly placed in the Category II Mid-Atlantic haul/ beach seine fishery in the mid-Atlantic zone described. This fishery can be prosecuted right off the beach (6 feet) or in nearshore coastal waters to offshore waters (250 feet). The eastern boundary of this fishery is a line drawn at 72° 30' W long. from Long Island south to 36º 33.03' N lat., then east to the EEZ, and then south to the North Carolina/South Carolina border. The area does not include waters where Category II and III inshore gillnet fisheries operate in bays, estuaries, and rivers.Figures 6-10 document the distribution of sets and marine mammal interactions observed from 20062005 to 20102009 respectively.~~

~~Gear Characteristics: The Mid-Atlantic Gillnet Fishery utilizes both drift and sink gillnets, including nets set in a sink, stab, set, strike, or drift fashion. These nets are most frequently attached to the bottom, although unanchored drift or sink nets are also utilized to target specific species. Monofilament twine is the dominant material used with stretched mesh sizes ranging from 2.5 to 12 inches. String lengths range from 150 to 8,400 feet. The mesh size and string length vary by the primary fish species targeted for catch.~~

~~Management and Regulations: The Mid-Atlantic Gillnet Fishery is defined as a Category I fishery in the 2012 List of Fisheries 76 FR 73912;November 29, 2011)..has been defined as a Category I fishery in the 2011 List of Fisheries (75 FR 68468, November 8, 2010, 50 CFR Part 229). This gear is addressed by several federal FMPs, Inter-State Fishery Management Plans (ISFMP's) managed by the Atlantic States Marine Fisheries Commission (ASMFC), the ALWTRP, the HPTRP, and the Bottlenose Dolphin TRP (BDTRP). The eastern boundary of this fishery is a line~~

~~drawn at 72° 30' W long. from Long Island south to 36º 33.03' N lat., then east to the EEZ, and then south to the North Carolina/South Carolina border. The area does not include waters where Category II and III inshore gillnet fisheries operate in bays, estuaries, and rivers. The relevant FMPs include, but may not be limited to: Atlantic Bluefish (FR 68(91), 50 CFR Part 648.160 through 648.165); Weakfish (FR 68(191), 50 CFR 697.7); Shad and River Herring (ASMFC ISFMP 2002); Striped Bass (FR68(202), 50 CFR part 697.7); Spanish Mackerel (FR 65(92), 50 CFR 622.1 through 622.48); Monkfish (FR 68(81), 50 CFR Part 648.91 through 648.97); Spiny Dogfish (FR 65(7), 50 CFR Part 648.230 through 648.273); Summer Flounder, Scup and Black Sea Bass (FR 68(1), 50 CFR part 648.100 through 648.147); Northeast Skate Complex (FR 68(160), 50 CFR part 648.320 through 648.322); and Atlantic Coastal Sharks (FR 68(247), 50 CFR 600-635). These fisheries are primarily managed by TACs; individual trip limits (i.e., quotas); effort caps (i.e., limited number of days at sea per vessel); time and area closures; and gear restrictions.~~

Observer Coverage: During the period 1995-2011, the estimated percent observer coverage was 5, 4, 3, 5, 2, 2, 2, 1, 1, 2, 3, 4, 4, 3, 3, 4 and 2 respectively.
~~Observer Coverage: During the period 1995-2010~~2009, the estimated percent observer coverage was 5, 4, 3, 5, 2, 2, 2, 1, 1, 2, 3, 4, 4, 3, and 3 and 4 ~~respectively.~~

Comments: Effort patterns in this fishery are heavily influenced by marine mammal time/area closures and /or gear restrictions under the ALWTRP, HPTRP, and BDTRP; and gear restrictions due to fish conservation measures.

~~Protected Species Interactions: Documented interactions~~interaction with harbor porpoise, white-sided dolphin, harbor seal, gray seal, harp seal, estuarine bottlenose dolphin, coastal bottlenose dolphin, offshore bottlenose dolphin, common dolphin, minke whale (Canadian East Coast stock), humpback whale (Gulf of Maine stock), Risso's dolphin, white-sided dolphin and long-finned and short-finned pilot whale were reported in this fishery. Not mentioned here are possible interactions with sea turtles and sea birds and interactions with large whale species in which the gear may not be identified to a specific area or gear.

Mid-Atlantic Bottom Trawl

Current category: Category II

Basis for current classification on the LOF: The total mortality and serious injury of common dolphins (Western North Atlantic [WNA] stock), long-finned pilot whales (WNA stock), Risso's dolphins (WNA), and short-finned pilot whales (WNA stock) in this fishery is greater than 1% and less than 50% of each of the stocks' PBR.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, Western North Atlantic (WNA)(1); harbor seal, WNA; Long-finned pilot whale, WNA (1); Risso's dolphin, WNA (1); Short-finned pilot whale, WNA(1); Whitesided dolphin, WNA. Not mentioned here are possible interactions with sea turtles and sea birds.

Gear description/method for fishing: This fishery uses bottom trawl gear. Gear types such as flynets utilized in the mid-Atlantic region. The Mid-Atlantic bottom trawls using flynets target species through nearshore and offshore components that operate along the east coast of the mid-Atlantic United States. Flynets typically range from 80–120 ft. (24–36.6 m) in headrope length, with wing mesh sizes of 16–64 in (41–163 cm), following a slow 3:1 taper to smaller mesh sizes in the body, extension, and codend sections of the net.

Target species: Target species include, but are not limited to: bluefish, croaker, monkfish, summer flounder (fluke), winter flounder, silver hake (whiting), spiny dogfish, smooth dogfish, scup, and black sea bass. The nearshore fishery targets Atlantic croaker, weakfish, butterfish, harvestfish, bluefish, menhaden, striped bass, kingfish species, and other finfish species; the deeper water fisheries target bluefish, Atlantic mackerel, Loligo squid, black sea bass, and scup.

Spatial/temporal distribution of effort: The fishery occurs year-round from all waters due east from the NC/SC

border to the EEZ and north to Cape Cod, MA in waters west of 70° W. long. In areas where 70° W. long. is east of the EEZ, the EEZ serves as the eastern boundary. The nearshore fishery operates from October to April inside of 30 fathoms (180 ft.; 55 m.) from NJ to NC. Flynet fishing is no longer permitted in Federal waters south of Cape Hatteras in order to protect weakfish stocks. The offshore component operates from November to April outside of 30 fathoms (180 ft.; 55 m.) from the Hudson Canyon off NY, south to Hatteras Canyon off NC. Figures 11-15 document the distribution of tows and marine mammal interactions observed from 2007 to 2011, respectively.

Management and regulations: There are at least two distinct components to this fishery. One is the mixed groundfish bottom trawl fishery. It is managed by several federal and state FMPs that range from Massachusetts to North Carolina. The relevant FMPs include, but may not be limited to, Monkfish (FR 68(81), 50 CFR Part 648); Spiny Dogfish (FR 65(7), 50 CFR Part 648); Summer Flounder, Scup, and Black Sea Bass (FR 68(1), 50 CFR part 648); and Northeast Skate Complex (FR 68(160), 50 CFR part 648). The second major component is the squid, mackerel, butterfish fishery. This component is managed by the federal Squid, Mackerel, Butterfish FMP. The *Illex* and *Loligo* Squid Fisheries are managed by moratorium permits, gear and area restrictions, quotas, and trip limits. The Atlantic Mackerel and Atlantic Butterfish Fisheries are managed by an annual quota system.

~~Target Species: Include, but are not limited to: Atlantic Cod, Haddock, Pollock, Yellowtail Flounder, Winter Flounder, Witch Flounder, American Plaice, Atlantic Halibut, Redfish, Windowpane Flounder, Summer Flounder, Spiny and Smooth Dogfish, Monkfish, Silver Hake, Red Hake, White Hake, Ocean Pout, Scup, Black Sea Bass, Skate spp, Atlantic Mackerel, *Loligo* Squid, *Illex* Squid, and Atlantic Butterfish.~~

~~Number of Permit Holders: In 2010, 8182009, 666 federal mid-Atlantic permit holders identified bottom trawl (including beam, bottom fish, bottom shrimp,, and bottom scallop trawls) as a potential gear type.~~

~~Number of Active Permit Holders: In 20102009, approximately 359273 federal mid-Atlantic permit holders reported the use of bottom trawls in the Northeast Region Dealer Reported Landings Database.~~

Mixed Groundfish Bottom Trawl Total Effort: Total effort, measured in trips, for the Mixed Groundfish Trawl from 1998 to 2011~~02009~~ was 27,521, 26,525, 24,362, 27,890, 28,103, 25,725, 22,303, 15,070, 12,457, 11,279, 10,785, 10,497, ~~and~~ 10,849~~497~~ and 10,528 respectively (NMFS). The number of days absent from port, or days at sea, is yet to be determined.

Squid, Mackerel, Butterfish Bottom Trawl Total Effort: Total effort, measured in trips, for the domestic Atlantic Mackerel Fishery in the Mid-Atlantic Region (bottom trawl only) from 1997 to 2011~~0~~ was~~2009 were~~ 373, 278, 262, 102, 175, 310, 238, 231, 0, 117, 88, 0, 66, ~~and~~ 19~~66~~, and 13 respectively (NMFS). Total effort, measured in trips, for the *Illex* Squid Fishery from 1998 to 2011~~0~~ was~~2009 were~~ 412, 141, 108, 51, 39, 103, 445, 181, 159, 103, 172, ~~and~~ 177 ~~and~~, 231, and 232respectively~~respectively~~ (NMFS). Total effort, measured in trips, for the *Loligo* Squid Fishery from 1998 to 201~~0~~1 was~~2009 were~~ 1,048, 495, 529, 413, 3,585, 1,848, 1,124, 1,845, 3,058, 2,137, 2,578, 2,234, ~~and~~ 2,039, and 2,157~~,234~~ respectively (NMFS). Atlantic Butterfish is a bycatch (non-directed) ~~fishery,~~fishery; therefore effort on this species will not be reported. The number of days absent from ~~port,~~port or days at sea, is yet to be determined.

~~Temporal and Spatial Distribution: The Mixed Groundfish Fishery occurs year-round from Cape Cod, Massachusetts to Cape Hatteras, North Carolina. Because of spatial and temporal differences in the harvesting of *Illex* and *Loligo* Squid and Atlantic Mackerel, each one of these sub-fisheries is described separately. Figures 11-15 document the distribution of tows and marine mammal interactions observed from 20062005 to 20102009 respectively.~~

~~***Illex* Squid**~~

~~The U.S. domestic fishery for *Illex* Squid, ranging from Southern New England to Cape Hatteras, North Carolina, reflects patterns in the seasonal distribution of *Illex* Squid (*Illex illecebrosus*). *Illex* is harvested offshore (along or outside of the 100-m isobath), mainly by small mesh otter trawlers, when the Squid are distributed in continental shelf and slope waters during the summer months (June-September) (Clark 1998).~~

~~***Loligo* Squid**~~

~~The U.S. domestic fishery for *Loligo* Squid (*Loligo pealeii*) occurs mainly in Southern New England and~~

mid-Atlantic waters. Fishery patterns reflect *Loligo* seasonal distribution, therefore most effort is directed offshore near the edge of the continental shelf during the fall and winter months (October-March) and inshore during the spring and summer months (April-September) (Clark 1998).

Atlantic Mackerel

The U.S. domestic fishery for Atlantic Mackerel (*Scomber scombrus*) occurs primarily in the Southern New England and mid-Atlantic waters between the months of January and May (Clark 1998). An Atlantic Mackerel Trawl Fishery also occurs in the Gulf of Maine during the summer and fall months (May-December) (Clark 1998).

Atlantic Butterfish

Atlantic Butterfish (*Peprilus triacanthus*) undergo a northerly inshore migration during the summer months, a southerly offshore migration during the winter months, and are mainly caught as bycatch to the directed Squid and Mackerel Fisheries. Fishery Observers suggest that a significant amount of Atlantic Butterfish discarding occurs at sea.

Gear Characteristics: The Mixed Groundfish Bottom Trawl Fishery gear characteristics have not yet been determined or summarized. The *Illex* and *Loligo* Squid Fisheries are dominated by small mesh otter trawls, but substantial landings of *Loligo* Squid are also taken by inshore pound nets and fish traps during the spring and summer months (Clark 1998). The Atlantic Mackerel Fishery is prosecuted by both mid-water (pelagic) and bottom trawls.

Management and Regulations: The Mid-Atlantic Bottom Trawl Fishery is defined as a Category II fishery in the 2012 List of Fisheries (76 FR 73912;November 29, 2011).has been defined as a Category II fishery in the 2010 List of Fisheries (74 FR 58859, November 16, 2009). There are at least two distinct components to this fishery. One is the mixed groundfish bottom trawl fishery. It is managed by several federal and state FMPs that range from Massachusetts to North Carolina. The relevant FMPs include, but may not be limited to, Monkfish (FR 68(81), 50 CFR Part 648.648.91 through 648.97); Spiny Dogfish (FR 65(7), 50 CFR Part 648.230 through 648.237); Summer Flounder, Scup, and Black Sea Bass (FR 68(1), 50 CFR part 648.100 through 648.147); and Northeast Skate Complex (FR 68(160), 50 CFR part 648.320 through 648.322). The second major component is the squid, mackerel, butterfish fishery. This component is managed by the federal Squid, Mackerel, Butterfish FMP (50 CFR Part 648.20 through 648.24). The *Illex* and *Loligo* Squid Fisheries are managed by moratorium permits, gear and area restrictions, quotas, and trip limits. The Atlantic Mackerel and Atlantic Butterfish Fisheries are managed by an annual quota system. Mid-Atlantic Bottom Trawl Fisheries are all included in the Atlantic Trawl Gear Take Reduction Strategy which recommends voluntary measures to reduce incidental interactions with marine mammals.

Observer Coverage: During the period 1996-2011, estimated percent observer coverage (measured in trips) for the Mixed Groundfish Bottom Trawl Fishery was 0.24, 0.22, 0.15, 0.14,1, 1, 1, 1, 3, 3, 2, 3, 3, 5, 5 and 7 respectively. Observer Coverage: During the period 1996-2010 2009, estimated percent observer coverage (measured in trips) for the Mixed Groundfish Bottom Trawl Fishery was 0.24, 0.22, 0.15, 0.14,1, 1, 1, 1, 3, 3, 2, 3, 3, 5 and 65 respectively.

During the period 1996-2011, estimated percent observer coverage (trips) in the *Illex* Fishery was 3.7, 6.21, 0.97, 2.84, 11.11, 0, 0, 8.74, 5.07, 6, 15, 14, 5, 10, 14 and 11 respectively. During the period 1996-2011, estimated percent observer coverage (trips) of the *Loligo* Fishery was 0.37, 1.07, 0.72, 0.69, 0.61, 0.95, 0.42, 0.65, 5.07, 4, 3, 2, 2, 7, 8 and 11 respectively. During the period 1997-2011, estimated percent observer coverage (trips) of the domestic Atlantic Mackerel Fishery was 0.81, 0, 1.14, 4.90, 3.43, 0.97, 5.04, 18.61, 0, 3, 2, 0, 8,11and 8 respectively. Observer coverage for 2010 and 2011 includes both observers and at-sea monitors.
During the period 1996-2010 2009, estimated percent observer coverage (trips) in the *Illex* Fishery was 3.7, 6.21, 0.97, 2.84, 11.11, 0, 0, 8.74, 5.07, 6, 15, 14, 5, 10 and 1410 respectively. During the period 1996-2010 2009, estimated percent observer coverage (trips) of the *Loligo* Fishery was 0.37, 1.07, 0.72, 0.69, 0.61, 0.95, 0.42, 0.65, 5.07, 4, 3, 2, 2, 7 and 87 respectively. During the period 1997-2010 2009, estimated percent observer coverage (trips) of the domestic Atlantic Mackerel Fishery was 0.81, 0, 1.14, 4.90, 3.43, 0.97, 5.04, 18.61, 0, 3, 2, 0, 8 and 118 respectively. Mandatory 100% observer coverage is required on any Joint Venture (JV) fishing operation. The most recent Atlantic Mackerel JV fishing activity occurred in 1998 and 2002 where 152 and 62 transfers from USA vessels were observed respectively. Only the net transfer operations from the USA vessel to the foreign processing vessel are observed. The actual net towing and hauling operations conducted on the USA vessel are not observed.

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of scup. The GRAs are spread out in time and space along the

edge of the Southern New England and Mid-Atlantic Continental Shelf Region (between 100 and 1000 meters). These seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. Access to the GRAs to harvest non-exempt species (*Loligo* Squid, Black Sea Bass, and Silver Hake) can be granted by a special permit. For detailed information regarding GRAs refer to (FR 70(2), (50 CFR Part 648.122 parts A and B)).

~~Protected Species Interactions: Documented interaction with harbor seal, common dolphin, long-finned pilot whale, short-finned pilot whale, Risso's dolphin, offshore~~ bottlenose ~~dolphin, and white-sided dolphin were reported in this fishery. Not mentioned here are possible interactions with sea turtles and sea birds.~~

Northeast Bottom Trawl

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury of white-sided dolphins (Western North Atlantic [WNA] stock) in this fishery is greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Gray seal, WNA; Harbor porpoise, Gulf of Maine/Bay of Fundy (GME/BF); Harbor seal, WNA; Harp seal, WNA; Long-finned pilot whale, WNA; Short-finned pilot whale, WNA; White-sided dolphin, WNA(1). Not mentioned here are possible interactions with sea turtles and sea birds.

Gear Characteristics: The average footrope length for the bottom trawl fleet was about 84 feet from 1996 – 1999; in 2000 there was a sharp increase to almost 88 feet followed by a steady decline to 85 feet in 2004. Seasonality was evident, with larger footrope lengths in the first quarter, which drop sharply from March to the low in May, and followed by a steady increase in size until December. There are some differences in mean gear size between species. Compared to other species, gear size was smaller for trips that caught winter flounder, cod, yellowtail flounder, fluke, skate, dogfish, and Atlantic herring. Trips that caught haddock, *Illex* squid, and monkfish tended to have larger gear. For most species, seasonal variation was limited. Seasonality was evident for witch flounder, American plaice, scup, butterfish, both squid species, and monkfish. Further characterization of the Northeast and Mid-Atlantic bottom and mid-water trawl fisheries based on Vessel Trip Report (VTR) data can be found at http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0715/).

Target species: This fishery targets species including, but not limited to: Atlantic cod, haddock, pollock, yellowtail flounder, winter flounder, witch flounder, American plaice, Atlantic halibut, redfish, windowpane flounder, summer flounder, spiny dogfish, monkfish, silver hake, red hake, white hake, ocean pout, and skate species.

Management and regulations: The fishery is primarily managed by TACs, individual trip limits (quotas), effort caps (limited number of days at sea per vessel), time and area closures, and gear restrictions under several interstate and federal FMPs.

~~Target Species: Atlantic Cod, Haddock, Pollock, Yellowtail Flounder, Winter Flounder, Witch Flounder, American Plaice, Atlantic Halibut, Redfish, Windowpane Flounder, Summer Flounder, Spiny Dogfish, Monkfish, Silver Hake, Red Hake, White Hake, Ocean Pout, *Loligo* squid and Skate spp.~~

~~Number of Permit Holders: In 2010, 1,227~~2009~~, 2,057 federal northeast permit holders identified bottom trawl (including beam, bottom fish, bottom shrimp,, and bottom scallop trawls) as a potential gear type.~~

~~Number of Active Permit Holders: In 2010, 218~~2009~~, 164 federal northeast permit holders reported the use of bottom trawls in the Northeast Region Dealer Reported Landings Database.~~

Total Effort: Total effort, measured in trips, for the Northeast Bottom Trawl Fishery from 1998 to 2011~~02009~~ was 13,263, 10,795, 12,625, 12,384, 12,711, 11,577, 10,354, 10,803, 8,603, 8,950,~~ and~~ 8,900~~ and~~, 6,791 and 5,747 respectively (NMFS).

Spatial/temporal distribution of effort: The fishery operates year-round, with a peak from May-July. The Northeast bottom trawl fishery includes all U.S. waters south of Cape Cod, MA that are east of 70° W and extending south to the intersection of the Exclusive Economic Zone (EEZ) and 70° W (approximately 37° 54' N), as well as all U.S. waters north of Cape Cod to the Maine-Canada border.~~Temporal and Spatial Distribution: Effort occurs year-round with a peak during May, June, and July primarily on the continental shelf and is distributed throughout the Gulf of Maine, Georges Bank and Southern New England Regions.~~ Figures 16-20 document the distribution of tows and marine mammal interactions observed from ~~2006~~~~2005~~2007 to ~~2010~~~~2009~~2011 respectively .

~~Gear Characteristics: The average footrope length for the bottom trawl fleet was about 84 feet from 1996 – 1999; in 2000 there was a sharp increase to almost 88 feet followed by a steady decline to 85 feet in 2004. Seasonality was evident, with larger footrope lengths in the first quarter, which drop sharply from March to the low in May, and followed by a steady increase in size until December. There are some differences in mean gear size between species. Compared to other species, gear size was smaller for trips that caught winter flounder, cod, yellowtail flounder, fluke, skate, dogfish, and Atlantic herring. Trips that caught haddock, *Illex* squid, and monkfish tended to have larger gear. For most species, seasonal variation was limited. Seasonality was evident for witch flounder, American plaice, scup, butterfish, both squid species, and monkfish. Further characterization of the Northeast and Mid-Atlantic bottom and mid-water trawl fisheries based on Vessel Trip Report (VTR) data can be found at~~
~~http~~http://www.nefsc.noaa.gov/nefsc/publications/crd/crd0715/://www.nefsc.noaa.gov/nefsc/publications/crd/crd0715/).~~
~~).~~

~~Management and Regulations: The Northeast Bottom Trawl Fishery ishas been defined as a Category II fishery in the 20122010 List of Fisheries (76 FR 73912;November 29, 2011).(74 FR 58859, November 16, 2009). This gear is managed by several federal and state FMPs that range from Maine to Connecticut and included in the Atlantic Trawl Gear Take Reduction Strategywhich recommends voluntary measures to reduce incidental interactions with marine mammals.Strategy. The relevant FMPs include, but may not be limited to: the Northeast Multi-species (FR 67, CFR Part 648); Monkfish (FR 68(81), 50 CFR Part 648.91 through 648.97); Spiny Dogfish (FR 65(7), 50 CFR Part 648.230 through 648.237); Summer Flounder, Scup and Black Sea Bass (FR 68(1), 50 CFR part 648.100 through 648.147); Atlantic Bluefish (FR 68(91), 50 CFR Part 648.160 through 648.165); and Northeast Skate Complex (FR 68(160), 50 CFR part 648.320 through 648.322). These fisheries are primarily addressed by TACs; individual trip limits (i.e., quotas); effort caps (i.e., limited number of days at sea per vessel); time and area closures; and gear restrictions.~~

Observer Coverage: During the period 1994-2011, estimated percent observer coverage (measured in trips) was 0.4, 1.1, 0.2, 0.2, 0.1, 0.3, 1.0, 1.0, 3, 4, 5, 12, 6, 6, 8 , 9, 16 and 26 respectively. Observer coverage for 2010 and 2011 includes both observers and at-sea monitors.
~~Observer Coverage: During the period 1994-20102009, estimated percent observer coverage (measured in trips) was 0.4, 1.1, 0.2, 0.2, 0.1, 0.3, 1.0, 1.0, 3, 4, 5, 12, 6, 6, 8 , 9 and 169 respectively.~~

~~Vessels in the Northeast Bottom Trawl Fishery, a Category II fishery under the MMPA, were observed in order to meet fishery management needs rather than monitoring for bycatch of marine mammals.~~

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of Scup. The GRAs are spread out in time and space along the edge of the Southern New England and mid-Atlantic continental shelf region (between 100 and 1000 meters). These seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. For detailed information regarding GRAs refer to (50 CFR Part 648.122 parts A and B).

~~Protected Species Interactions: Documented interaction with offshore bottlenose dolphin, common dolphin, harbor porpoise, gray seal, harbor seal, harp seal, long finned pilot whale, short finned pilot whale, Risso's dolphin and white-sided dolphin were reported in this fishery. Not mentioned here are possible interactions with sea turtles and sea birds.~~

Northeast Mid-Water Trawl Fishery (includes pair trawls)

~~Target Species: Atlantic Herring and miscellaneous pelagic species.~~

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury of long-finned pilot whales (Western North Atlantic [WNA] stock) and short-finned pilot whales (WNA stock) in this fishery is greater than 1% and less than 50% of the stocks' Potential Biological Removal (PBR).

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Harbor seal, WNA; Long-finned pilot whale, WNA (1); Short-finned pilot whale, WNA(1); Whitesided dolphin, WNA. Not mentioned here are possible interactions with sea turtles and sea birds.

~~Number of Permit Holders: In 2010, 6982009, 1,222 federal Northeast permit holders identified mid-water trawl as a potential gear type.~~

~~Number of Active Permit Holders: In 2010, 142009, 21 federal northeast permit holders reported the use of mid-water trawls in the Northeast Region Dealer Reported Landings Database.~~

Gear description/method for fishing: This fishery uses primarily mid-water (pelagic) trawls (single and paired), which is trawl gear designed, capable, or used to fish for pelagic species with no portion designed to be operated in contact with the bottom.

Target species: This fishery targets Atlantic herring with bycatch of several finfish species, predominantly mackerel, spiny dogfish, and silver hake.

Spatial/temporal distribution of effort: The fishery occurs primarily in Maine state waters, Jeffrey's Ledge, southern New England, and Georges Bank during the winter months when the target species continues its southerly migration from the Gulf of Maine/Georges Bank, into mid-Atlantic waters. This fishery includes all U.S. waters south of Cape Cod, MA that are east of 70° W and extending south to the intersection of the EEZ and 70° W (approximately 37° 54'N), as well as all U.S. waters north of Cape Cod to the Maine-Canada border." Figures 21-25 document the distribution of tows and marine mammal interactions observed from ~~20062005~~2007 to ~~20102009~~2011 respectively.~~Gear Characteristics: Historically, the Atlantic Herring resource was harvested by the Distant Water Fleet (DWF) until the fishery collapsed in the late 1970s. There has been no DWF since then. A domestic fleet has been harvesting the Atlantic Herring resource utilizing both fixed and mobile gears. Only a small percentage of the resource is currently harvested by fixed gear due to a combination of reduced availability and less use of fixed gear (Clark 1998). The majority of the resource is currently harvested by domestic mid-water (pelagic) trawls (single and paired).~~

Management and regulations: The fishery is managed jointly by the Mid-Atlantic Fishery Management Council, Mid-Atlantic Fishery Management Council, and the Atlantic States Marine Fisheries Commission. This fishery is included in the Atlantic Trawl Gear Take Reduction Strategy which recommends voluntary measures to reduce incidental interactions with marine mammals.

~~Management and Regulations: The Northeast Mid-Water Trawl Fishery is~~~~has been defined as a Category II fishery in the 2012~~~~2010 List of Fisheries (76 FR 73912;November 29, 2011).(74 FR 58859, November 16, 2009). Atlantic herring are managed jointly by the MAFMC and ASMFC as one migratory stock complex, and by the Atlantic Trawl Gear Take Reduction Team. There has been a domestic resurgence in a directed fishery on the adult stock due to the recovery of the adult stock biomass. Northeast Mid-Water Trawl Fishery is included in the Atlantic Trawl Gear Take Reduction Strategy which recommends voluntary measures to reduce incidental interactions with marine mammals..~~.

~~Temporal and Spatial Distribution: The current fishery occurs during the summer months when the resource is~~

~~distributed throughout the Gulf of Maine and Georges Bank regions. The stock continues on a southerly migration into mid-Atlantic waters during the winter months. Figures 21-25 document the distribution of tows and marine mammal interactions observed from 20062005 to 20102009 respectively.~~

Total Effort: Total effort, measured in trips, for the Northeast Mid-Water Trawl Fishery (across all gear types) from 1997 to 2011~~02009~~ was 578, 289, 553, 1,312, 2,404, 1,736, 2,158, 1,564, 717, 590, 286, 236, ~~236~~ 236,~~and~~ 294, and 331~~236~~ respectively (NMFS).

~~O~~Observer Coverage: During the period 1997-2011, estimated percent observer coverage (trips) was 0, 0, 0.73, 0.46, 0.06, 0, 2.25, 11.48, 19.9, 3.1, 8.04, 19.92, 42, 53, and 41 respectively. Observer coverage for 2010 and 2011 includes both observers and at-sea monitors.
~~During the period 1997 2010~~2009, estimated percent observer coverage (trips) was 0, 0, 0.73, 0.46, 0.06, 0, 2.25, 11.48, 19.9, 3.1, 8.04, 19.92, 42 and 53~~42~~ respectively. Observer coverage for 2010 includes both observers and at-sea monitors. A U.S. JV Mid-Water (pelagic) Trawl Fishery was conducted on Georges Bank from August to December 2001. A total allowable landings of foreign fishery (TALFF) was also granted during the same time period. Ten vessels (3 foreign and 7 American), fishing both single and paired mid-water trawls, participated in the 2001 Atlantic Herring JV Fishery. Two out of the three foreign vessels also participated in the 2001 TALFF and fished with paired mid-water trawls. The NMFS maintained 74% observer coverage (243 hauls) on the JV transfers and 100% observer coverage (114 hauls) on the foreign vessels granted a TALFF.

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of Scup. The GRAs are spread out in time and space along the edge of the Southern New England and mid-Atlantic continental shelf region (between 100 and 1000 meters). These seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. For detailed information regarding GRAs refer to (50 CFR Part 648.122 parts A and B)

~~Protected Species Interactions: Documented interaction with harbor seal, long-finned pilot whale, short-finned pilot whale, offshore bottlenose dolphin, and white-sided dolphin were reported in this fishery. Not mentioned here are possible interactions with sea turtles and sea birds.~~

Mid-Atlantic Mid-Water Trawl Fishery (includes pair trawls)

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury of white-sided dolphins (Western North Atlantic [WNA] stock) in this fishery is greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks injured/killed (a (1)indicates those stocks driving the fishery's classification): Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Long-finned pilot whale, WNA; Risso's dolphin, WNA; Short-finned pilot whale, WNA; White-sided dolphin, WNA (1) Not mentioned here are possible interactions with sea turtles and sea birds.
~~Target Species: Atlantic Mackerel, Chub Mackerel and other miscellaneous pelagic species.~~

~~Number of Permit Holders: In 2010, 4982008, 358 federal mid-Atlantic permit holders identified mid-water trawl as a potential gear type.~~

~~Number of Active Permit Holders: In 2010, 172009, 22 federal mid-Atlantic permit holders reported the use of mid-water trawls in the Northeast Region Dealer Reported Landings Database.~~
Gear description/method for fishing: This fishery uses both single and pair trawls, which are designed, capable, or used to fish for pelagic species with no portion of the gear designed to be operated in contact with the bottom of the ocean.

Target species: Atlantic mackerel, chub mackerel, and miscellaneous other pelagic species.

Spatial/temporal distribution of effort: The fishery for Atlantic mackerel occurs primarily from southern New England through the mid-Atlantic from January-March and in the Gulf of Maine during the summer and fall (May-December). The Mid-Atlantic mid-water trawl fishery includes all waters due east from the NC/SC border to the EEZ and north to Cape Cod, MA in waters west of 70° W. long. Figures 26-30 document the distribution of tows and marine mammal interactions observed from 200~~6~~7 to 201~~0~~1 respectively.

Management and regulations: This fishery is managed under the Federal Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan using an annual quota system. ~~Management and Regulations: The Mid-Atlantic Mid-Water Trawl Fishery ishas been defined as a Category II fishery in the 20122011 List of Fisheries (76 FR 73912;November 29, 2011).(75 FR 68468, November 8, 2010).~~ This fishery is included in the Atlantic Trawl Gear Take Reduction Strategy which recommends voluntary measures to reduce incidental interactions with marine mammals.

~~Temporal and Spatial Distribution: To be determined. Figures 26-30 document the distribution of tows and marine mammal interactions observed from 20062005 to 20102009 respectively.~~

Total Effort:. Total effort, measured in trips, for the Mid-Atlantic Mid-Water Trawl Fishery (across both gear types) from 1997 to 2011~~02009~~ was 331, 223, 374, 166, 408, 261, 428, 360, 359, 405, 312, 255, 280, ~~and~~ 173, and 140~~280~~ respectively (NMFS).

Observer Coverage: During the period 1997-2011, estimated percent observer coverage (trips) was 0, 0, 1.01, 8.43, 0, 0.77, 3.50, 12.16, 8.40, 8.90, 3.85, 13.33, 13.2, 25and 41 respectively. Observer coverage for 2010 and 2011 includes both observers and at-sea monitors.
~~Observer Coverage:. During the period 1997-20102009, estimated percent observer coverage (trips) was 0, 0, 1.01, 8.43, 0, 0.77, 3.50, 12.16, 8.40, 8.90, 3.85, 13.33, and 13.2 and 25 respectively. Observer coverage for 2010 includes both observers and at-sea monitors.~~

Comments: Mobile Gear Restricted Areas (GRAs) were put in place for fishery management purposes in November 2000. The intent of the GRAs is to reduce bycatch of Scup. The GRAs are spread out in time and space along the edge of the Southern New England and mid-Atlantic continental shelf region (between 100 and 1000 meters). These seasonal closures are targeted at trawl gear with small-mesh sizes (<4.5 inches inside mesh measurement). The Atlantic Herring and Atlantic Mackerel Trawl Fisheries are exempt from the GRAs. For detailed information regarding GRAs refer to (50 CFR Part 648.122 parts A and B).

~~Protected Species Interactions: . Documented interaction with offshore bottlenose dolphin, common dolphin, long-finned pilot whale, Risso's dolphin, short-finned pilot whale and white-sided dolphin were reported in this fishery. Not mentioned here are possible interactions with sea turtles and sea birds.~~

Bay of Fundy Herring Weir

Target Species: Atlantic Herring

Category: N/A

Protected Species Interactions: Documented interactions with harbor porpoise and minke whales were reported in this fishery. Right whales are also vulnerable to entrapment, though very rarely.

Gear Characteristics: Weirs are large, heart-shaped structures (roughly 100 feet across) consisting of long wooden stakes (50-80 feet) pounded 3-6 feet into the sea floor and surrounded by a mesh net (the "twine") of about ¾ inch stretch mesh. Weirs are typically located within 100-400 feet of shore. The twine runs from the sea floor to the surface, and the only opening (the "mouth") is positioned close to shore. Herring swimming along the shore at night, encounter a fence (net of the same twine from sea floor to surface) that runs from the weir to the shoreline and directs the fish into the weir. At dawn, the weir fisherman tends the weir and if Herring are present, he/she may close off the weir until the fish can be harvested. Harvesting takes place when the tidal current is the slackest, usually just before low tide. A large net ("seine") is deployed inside the weir, and, much like a purse seine, it is

drawn up to the surface so that the fish become concentrated. They are then pumped out with a vacuum hose into the waiting carrier for transport to the processing plant.

Temporal and Spatial Distribution: In Canadian waters, the Herring Weir Fishery occurs from May to October along the southwestern shore of the Bay of Fundy, and is scattered along the coasts of western Nova Scotia.

Management and Regulations: To Be Determined

~~Number of Permit Holders: According to Canadian DFO officials, for 1998 there were 225 licenses for herring weirs on the New Brunswick and Nova Scotia sides of the Bay of Fundy (60 from Grand Manan Island, 95 from Deer and Campobello Islands, 30 from Passamaquoddy Bay, 35 from the East Charlotte area, and 5 from the Saint John area). The number of licenses has been fairly consistent since 1985 (Ed Trippel, pers. comm.)~~

~~Number of Active Permit Holders: In 2002 around Grand Manan Island, the only area surveyed for active weirs, there were 22 active weirs. In 2003 the number of active weirs included: 20 around Grand Manan Island, 9 around the Wolves Islands, 10 around Campobello Island, 2 at Deer Island, and 43 in Passamaquoddy Bay and the western Bay of Fundy. The numbers in the eastern Bay of Fundy are unknown, but some do exist.~~

Total Effort: Effort is difficult to measure. Weirs may or may not have twine (i.e., be actively fishing) on them in a given year and the amount of time the twine is up varies from year to year. Most weirs tend to fish (i.e., have twine on them) during July, August, and September. Some fishermen keep their twine on longer, into October and November, if it is a good year or there haven't been any storms providing incentive to take the twine down. Effort cannot simply be measured by multiplying the number of weirs with twine times the average number of fishing days (this will provide a very generous estimation of effort) because if a weir fills up with fish the fisherman will pull up the drop (close the net at the mouth) which prevents loss of fish, but also means no new fish can get in, therefore the weir is not actively fishing during that period.

~~Temporal and Spatial Distribution: In Canadian waters, the Herring Weir Fishery occurs from May to October along the southwestern shore of the Bay of Fundy, and is scattered along the coasts of western Nova Scotia.~~

~~Gear Characteristics: Weirs are large, heart-shaped structures (roughly 100 feet across) consisting of long wooden stakes (50-80 feet) pounded 3-6 feet into the sea floor and surrounded by a mesh net (the "twine") of about ¾ inch stretch mesh. Weirs are typically located within 100-400 feet of shore. The twine runs from the sea floor to the surface, and the only opening (the "mouth") is positioned close to shore. Herring swimming along the shore at night, encounter a fence (net of the same twine from sea floor to surface) that runs from the weir to the shoreline and directs the fish into the weir. At dawn, the weir fisherman tends the weir and if Herring are present, he/she may close off the weir until the fish can be harvested. Harvesting takes place when the tidal current is the slackest, usually just before low tide. A large net ("seine") is deployed inside the weir, and, much like a purse seine, it is drawn up to the surface so that the fish become concentrated. They are then pumped out with a vacuum hose into the waiting carrier for transport to the processing plant.~~

~~Management and Regulations: To Be Determined~~

Observer Coverage: From mid-July to early September, on a daily basis, scientists from the Grand Manan Whale & Seabird Research Station check only the weirs around Grand Manan Island for the presence of cetaceans.

Comments: Marine mammals occasionally swim into weirs, in which they can breathe and move about. Marine mammals are vulnerable during the harvesting/seining process where they can become tangled in the seine and suffocate if care is not taken to remove them from the net or to remove them from the weir prior to the onset of the seining process. Small marine mammals, like porpoises, can be removed from the net, lifted into small boats, and taken out of the weir for release without interrupting the seining process. Larger marine mammals, such as whales, must be removed from the weir either through the creation of a large enough escape hole in the back of the weir (taking down the twine and removing some poles) or sometimes by sweeping them out with a specialized mammal net, although this approach carries with it a few more risks to the animal than the "escape hole" technique.

Through the cooperation of weir fishermen and the Grand Manan Whale & Seabird Research Station, weir-associated mortality of cetaceans is relatively low. Over 91% of all entrapped porpoises, dolphins and whales are successfully released from weirs around Grand Manan Island. Thus the total number of entrapments (which can vary annually from 6 to 312) is in no way reflective or indicative of cetacean mortality caused by this fishery.

~~Protected Species Interactions: Documented interactions with harbor porpoise and minke whales were reported in this fishery. Right whales are also vulnerable to entrapment, though very rarely. The last two minke whales in a Grand Manan weir were safely released, unharmed, through the partial disassembly of the weir.~~

Gulf of Maine Atlantic Herring Purse Seine Fishery

Target Species: Atlantic Herring.

Category: III

Protected Species Interactions: Documented interactions with humpback whale, fin/sei whale, minke whale, harbor porpoise, harbor seal, gray seal and white-sided dolphin have been reported in this fishery, though generally the animals have been released from the net unharmed.

~~Number of Permit Holders: In 2010, 3652009, 305 northeast federal permit holders identified herring purse seine as a potential gear type.~~

~~Number of Active Permit Holders: The Atlantic Herring FMP distinguishes between vessels catching herring incidentally while pursuing other species and those targeting herring by defining vessels that average less than 1 metric tons of herring caught per trip (in all areas) as incidental herring vessels. In 20102009 there were 115 active federal permits reported in the Northeast Region Dealer Reported Landings Database.~~

Gear Characteristics: The purse seine is a deep nylon mesh net with floats on the top and lead weights on the bottom. Rings are fastened at intervals to the lead line and a purse line runs completely around the net through the rings (www.gma.org, Gulf of Maine Research Institute, GOMRI). One end of the net remains in the vessel and the other end is attached to a power skiff or "bug boat" that is deployed from the stern of the vessel and remains in place while the vessel encircles a school of fish with the net. Then the net is pursed and brought back aboard the vessel through a hydraulic power block. Purse seines vary in size according to the size of the vessel and the depth to be fished. Most purse seines used in the New England Herring Fishery range from 30 to 50 meters deep (100-165 ft.) (NMFS 2005). Purse seining is a year round pursuit in the Gulf of Maine, but is most active in the summer when herring are more abundant in coastal waters and are mostly utilized at night, when herring are feeding near the surface. This fishing technique is less successful when fish remain in deeper water and when they do not form "tight" schools.

Target Species: Atlantic herring

Temporal and Spatial Distribution: Most U.S. Atlantic herring catches occur between May and October in the Gulf of Maine, consistent with the peak season for the lobster fishery. The connection between the herring and lobster fisheries is the reliance of the lobster industry on herring for bait. In addition, there is a relatively substantial winter fishery in southern New England, and catches from Georges Bank have increased somewhat in recent years. There is a very small recreational fishery for Atlantic herring that generally occurs from early spring to late fall, and herring is caught by tuna boats with gillnets for use as live bait in the recreational tuna fisheries. In addition, there is a Canadian fishery for Atlantic herring from New Brunswick to the Gulf of St. Lawrence, which primarily utilizes fixed gear. Fish caught in the New Brunswick (NB) weir fishery are assumed to come from the same stock (inshore component) as that targeted by U.S. fishermen (http://www.nefmc.org/herring/index.html, Northeast Fisheries Management Council, NEFMC). Figures 31-35 document the distribution of sets and marine mammal interactions observed from 200~~6~~7 to 201~~0~~1, respectively.

Management and Regulations: The Gulf Of Maine Atlantic Herring Purse Seine Fishery is~~has been~~ defined as a Category III fishery in the 2010 List of Fisheries (74 FR 58859, November 16, 2009).fishery. This gear is managed

by federal and state FMPs that range from Maine to North Carolina. The relevant FMPs include, but may not be limited to the Atlantic Herring FMP (FR 70(19), 50 CFR Part 648.200 through 648.207) and the Northeast Multi-species (FR 67, CFR Part 648.80 through 648.97). This fishery is primarily managed by total allowable catch (TACs).

~~Temporal and Spatial Distribution: Most U.S. Atlantic herring catches occur between May and October in the Gulf of Maine, consistent with the peak season for the lobster fishery. The connection between the herring and lobster fisheries is the reliance of the lobster industry on herring for bait. In addition, there is a relatively substantial winter fishery in southern New England, and catches from Georges Bank have increased somewhat in recent years. There is a very small recreational fishery for Atlantic herring that generally occurs from early spring to late fall, and herring is caught by tuna boats with gillnets for use as live bait in the recreational tuna fisheries. In addition, there is a Canadian fishery for Atlantic herring from New Brunswick to the Gulf of St. Lawrence, which primarily utilizes fixed gear. Fish caught in the New Brunswick (NB) weir fishery are assumed to come from the same stock (inshore component) as that targeted by U.S. fishermen (~~~~http~~http://www.nefmc.org/herring/index.html~~://www.nefmc.org/herring/index.html~~, Northeast Fisheries Management Council, NEFMC). Figures 31-35 document the distribution of sets and marine mammal interactions observed from 2006~~2004 to 2010~~2008, respectively.~~

Total Effort: Total metric tons of fish landed from 1998 to 2010~~01~~~~2008~~ were 24,256, 39,866, 29,609, 20,691, 20,096, 17,939, 19,958, 16,306, ~~d~~ 18,700, 31,019, ~~and~~ 27,327, 22,547, ~~and~~ 8,566, and 16,981 respectively (NMFS, Unpbl.). Total effort, measured in trips, for the Gulf of Maine Atlantic Herring Purse Seine Fishery from 2002 to 2011~~02006~~ was 343, 339, 276, 202, 173, 249, 344, 249, 228 ~~and~~, 242, 273 and 273~~249~~ respectively (NMFS, Unpbl.).

Observer Coverage: During the period 1994 to 2002, estimated observer coverage (number of trips observed/total commercial trips reported) was 0. From 2003 to 2011, percent observer coverage was 0.34, 9.8, 0.27, 0, 3.2, 12, 21, 12 and 33 respectively.
~~Observer Coverage: During the period 1994 to 2002, estimated observer coverage (number of trips observed/total commercial trips reported) was 0. From 2003 to 2010~~2008~~, percent observer coverage was 0.34, 9.8, 0.27, 0, 3.2, 12, 21 and 12~~11.2 respectively. The coverage in 2004 may be considered a 'pilot' program, as sampling priorities and data collection methods were refined over the course of the year.~~

~~Protected Species Interactions: Documented interactions with humpback whale, fin/sei whale, minke whale, harbor porpoise, harbor seal, gray seal and white-sided dolphin have been~~were reported in this fishery~~, though generally the animals have been released from the net unharmed.~~

Northeast/Mid-Atlantic American Lobster Trap/Pot

Current category: Category I

Basis for current classification on the LOF: The annual level of serious injury and mortality of North Atlantic right whales (Western North Atlantic [WNA] stock), humpback whales (Gulf of Maine stock), and minke whales (Canadian East Coast stock) in this fishery exceeds 50% of each stocks' Potential Biological Removal (PBR) level.

Current list of marine mammal species/stocks injured/killed (a (1)indicates those stocks driving the fishery's classification): Harbor seal, WNA; Humpback whale, Gulf of Maine; Minke whale, Canadian East Coast; North Atlantic right whale, WNA (1)
~~.In the United States (US), the American lobster, *Homarus americanus*, is distributed from Maine to North Carolina and is most abundant in relatively shallow coastal zones. Inshore landings have increased since the 1970s. Fishing effort is intense and increasing throughout the range of the resource. Approximately 80% of lobster landings are derived from state waters which occur from 0-3 miles from shore. There are three distinctly identified stock areas for the American lobster: 1) Gulf of Maine, 2) Southern New England, and 3) Georges Bank.~~Number of Permit Holders: ~~In 2010, approximately 3,147 vessels held permits to fish for and harvest lobsters in Federal waters, which does not include the several thousand vessels coastwide authorized to harvest lobster in state water.~~

~~Total Effort: American lobster is the most valuable fishery in the eastern US, with total landings of 116.9 million~~

~~lbs. valued at $401.7 million in 2010. Combined landings from Maine and Massachusetts vessels comprised 93% of the landings for 2010, with Maine landing 96.2 million lbs. in 2010. The majority of vessels harvest lobster with traps, with about 2-3% of the harvest taken by mobile gear (trawlers and dredges). The offshore fishery in Federal waters has developed in the past 15 years, largely due to technological improvements in equipment and lower competition in the offshore areas.~~

Gear description/method for fishing: –This fishery operates with traps. –2-3% of the target species are taken by mobile gear (trawls and dredges), that are classified within the Category III Northeast Shellfish Bottom Trawl fishery.

Target species: American lobster.

Spatial/temporal distribution of effort: –The fishery operates in inshore and offshore waters from Maine to New Jersey and may extend as far south as Cape Hatteras, North Carolina. -Approximately 80% of American lobsters are harvested from state waters.

Management and regulations: -The Atlantic States Marine Fisheries Commission has a primary regulatory role for this fishery because the majority of the harvest is taken from state waters. -The Exclusive Economic Zone (EEZ) portion of the fishery operates under regulations from the Federal American Lobster Fishery Management Plan (FMP). -Both the EEZ and state fishery are operating under Federal regulations from the Atlantic Large Whale Take Reduction Plan.

Levels of observer coverage each year: There has not been observer coverage in this fishery.

~~Management and Regulations: A cooperative state and Federal management plan is in place to manage the lobster resource and the plan is administered under the authority of the Atlantic Coastal Act, with oversight provided by the Atlantic States Marine Fisheries Commission (ASMFC). The ASMFC's role is to develop coastal fishery management programs, oversee state implementation of the coastal measures in state waters, and provide recommendations for the Federal government to implement complementary regulations in Federal waters. States implement management measures from 0-3 miles within their respective jurisdictions in compliance with the measures adopted in the management plan. The National Marine Fisheries Service is obliged to enact measures that support the plan in Federal waters, from 3-200 miles from shore, codified under 50 CFR 697.~~

~~American lobster is the most valuable fishery in the eastern US, with total landings of 100 million lbs. valued at $308.7 million in 2009. Combined landings from Maine and Massachusetts vessels comprised 92% of the landings for 2009, with Maine landing nearly 81 million lbs. in 2009. In 2009, approximately 3,183 vessels held permits to fish for and harvest lobsters in Federal waters, which does not include the several thousand vessels coastwide authorized to harvest lobster in state water. The majority of vessels harvest lobster with traps, with about 2-3% of the harvest taken by mobile gear (trawlers and dredges). The offshore fishery in Federal waters has developed in the past 15 years, largely due to technological improvements in equipment and lower competition in the offshore areas.~~

~~In January 1997, NMFS changed the classification of the Gulf of Maine and Mid-Atlantic Lobster Pot Fisheries from Category III to Category I (1997 List of Fisheries 62 FR 33, January 2, 1997) based on examination of 1990 to 1994 stranding and entanglement records of large whales (including Right, Humpback and Minke whales). Both the EEZ and state fishery are operating under Federal regulations from the ALWTRP (50 CFR 229.32). Documented interaction with minke whales were reported in this fishery.~~

~~Temporal and Spatial Distribution: In the United States (US), the American lobster, *Homarus americanus*, is distributed from Maine to North Carolina and is most abundant in relatively shallow coastal zones. Inshore landings have increased since the 1970s. Fishing effort is intense and increasing throughout the range of the resource. Approximately 80% of lobster landings are derived from state waters which occur from 0-3 miles from shore. There are three distinctly identified stock areas for the American lobster: 1) Gulf of Maine, 2) Southern New England, and 3) Georges Bank.~~

~~Protected Species Interactions: harbor seal, humpback whale, minke whale, North Atlantic right whale.~~

Atlantic Mixed Species Trap/Pot Fishery

Current category: Category II

Basis for current classification on the LOF: Based on analogy with the Category I "Northeast/Mid-Atlantic American lobster trap/pot fishery" and the Category II "Atlantic blue crab trap/pot fishery." The gear used in these lobster and crab pot fisheries, which have been involved in entanglement events, is similar to the gear used in this fishery.

Current list of marine mammal species/stocks injured/killed:- Fin whale, Western North Atlantic (WNA); Humpback whale, Gulf of Maine.

Gear description/method for fishing: -This fishery uses trap/pot gear.

Target species: -Targets species include, but are not limited to, hagfish, shrimp, conch/whelk, red crab, Jonah crab, rock crab, black sea bass, scup, tautog, cod, haddock, Pollock, redfish (ocean perch) white hake, spot, skate, catfish, stone crab, and cunner.

Spatial/temporal distribution of effort: –The fishery includes all trap/pot operations from the U.S.-Canada border south through the waters east of the fishery management demarcation line between the Atlantic Ocean and the Gulf of Mexico (50 CFR 600.105), but does not include the following Category I, II, and III trap/pot fisheries: Northeast/Mid-Atlantic American lobster trap/pot; Atlantic blue crab trap/pot; FL spiny lobster trap/ pot; Southeastern U.S. Atlantic, Gulf of Mexico stone crab trap/pot; U.S. Mid-Atlantic eel trap/pot; and the Southeastern U.S. Atlantic, Gulf of Mexico golden crab fisheries.

Management and regulations: The fishery is managed under various Interstate Fishery Management Plans and is subject to ALWTRP implementing regulations.

Levels of observer coverage each year: There has not been observer coverage in this fishery.

Atlantic Ocean, Caribbean, Gulf of Mexico Large Pelagics Longline

Current category: Category I

Basis for current classification on the LOF: The total annual mortality and serious injury of long-finned pilot whale (Western North Atlantic [WNA] stock), pygmy sperm whale (WNA stock), and short-finned pilot whale (WNA stock) in this fishery is greater than 50% of the stocks' Potential Biological Removal (PBR) levels.

Current list of marine mammal species/stocks injured/killed (a (1)indicates those stocks driving the fishery's classification): Atlantic spotted dolphin, Gulf of Mexico (GMX) continental and oceanic; Atlantic spotted dolphin, WNA; Bottlenose dolphin, Northern GMX continental shelf; Bottlenose dolphin, Northern GMX oceanic; Bottlenose dolphin, WNA offshore; Common dolphin, WNA; Cuvier's beaked whale, WNA; Gervais beaked whale, GMX oceanic stock; Killer whale, GMX oceanic stock; Long-finned pilot whale, WNA(1); Mesoplodon beaked whale, WNA; Northern bottlenose whale, WNA; Pantropical spotted dolphin, Northern GMX; Pantropical spotted dolphin, WNA; Risso's dolphin, Northern GMX; Risso's dolphin, WNA; Short-finned pilot whale, Northern GMX; Short-finned pilot whale, WNA(1); Sperm whale, GMX oceanic stock. Not mentioned here are documented interactions with sea turtles and sea birds.

~~Target Species: Large pelagic fish species including: Swordfish, Yellowfin Tuna, Bigeye Tuna, Bluefin Tuna, Albacore Tuna, Dolphin Fish, Shortfin Mako Shark, and a variety of other shark species.~~

~~Number of Permit Holders: < < 100~~

~~Number of Active Permit Holders: The number of fishing vessels in the Pelagic Longline Fishery has been declining since a peak number of 361 vessels reporting longline effort during 1995. Over the period between 1995 and 2000, the mean number of vessels reporting effort for the entire Atlantic Ocean not including the Gulf of Mexico was 163. This declined to an annual average of 72 for the period between 2001 and 2007. Seventy seven vessels reported pelagic longline effort in the Atlantic during 2008. It is likely that some of these vessels also reported effort in the Gulf of Mexico.~~

Gear description/method for fishing: ~~–~~The fishery uses a mainline of >700 lb (317.5 kg) test monofilament typically ranging from 10-45 mi (16-72 km) long. ~~-~~Bullet-shaped floats are suspended at regular intervals along the mainline and long sections of gear are marked by radio beacons. ~~–~~Long gangion lines of 200-400 lb (91-181 kg) test monofilament of typically 100-200 ft (30.5-61 m) are suspended from the mainline. Only certain sized hooks and baits are allowed based on fishing location. ~~-~~Hooks are typically fished at depths between 40-120 ft (12-36.6 m). Longlines targeting tuna are typically set at dawn are hauled near dusk, while longlines targeting swordfish are typically set at night and hauled in the morning. Gear remains in the water typically for 10-14 hours. Fishermen generally modify only select sections of longline gear to target dolphin fish or wahoo, with the remaining gear configured to target swordfish, tuna, and/or sharks.

Target species: Swordfish, tuna (yellowfin, bigeye, bluefin, and albacore), dolphin fish, wahoo, shortfin mako shark, and a variety of other shark species.

Temporal and Spatial Distribution: Fishing effort occurs year round and operates in waters both inside and outside the U.S. EEZ throughout Atlantic, Caribbean and Gulf of Mexico waters. The "Atlantic" component of the fleet operates both in coastal and continental shelf waters along the U.S. Atlantic coast from Florida to Massachusetts. The fle~~et al~~*et al*so operates in distant waters of the Atlantic including the central equatorial Atlantic Ocean and the Canadian Grand Banks. Fishing effort is reported in 11 defined fishing areas including the Gulf of Mexico. During 20~~08~~11, the majority of fishing effort ~~in the Atlantic~~ was reported in the Mid-Atlantic Bight (Virginia to New Jersey, 1,~~911~~323 sets) and the ~~South Atlantic Bight~~Gulf of Mexico ~~(Georgia to North Carolina,~~(~~-~~1,1~~26~~247 sets) fishing areas (Garrison ~~*et al*~~and Stokes~~.~~ 20~~09~~12).

Management and regulations: This fishery is managed under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (FMP). The dolphin fish and wahoo portions of the fishery are managed under the South Atlantic FMP for Dolphin and Wahoo. ~~-~~Regulations under the Magnuson-Stevens Fishery Conservation and Management Act address the target fish species, as well as bycatch species protected under the Endangered Species Act and/or the MMPA. ~~–~~A portion of this fishery is subject to regulations under the Pelagic Longline Take Reduction Plan (50 CFR 229.36).

Total Effort: The total fishing effort in the Atlantic component of the Pelagic Longline Fishery has been declining since a peak reported effort of 12,318 sets (7.41 million hooks) during 1995. The mean effort reported to the Fisheries Logbook System between 1995 and 2000 was 9,370 sets (5.62 million hooks). Between 2001 and 2007, a mean of 4,551 sets (3.19 million hooks) was reported each year. ~~-~~During ~~2008~~2011, the total reported fishing effort in ~~the Atlantic Ocean component of the fishery~~ was ~~5,684~~ 8,044 sets and ~~4.16~~5,955.8 ~~million~~ thousand hooks (Garrison ~~et al~~~~*et al*~~. ~~2009~~and Stokes 2012).

~~Temporal and Spatial Distribution: Fishing effort occurs year round and operates in waters both inside and outside the U.S. EEZ throughout Atlantic, Caribbean and Gulf of Mexico waters. The "Atlantic" component of the fleet operates both in coastal and continental shelf waters along the U.S. Atlantic coast from Florida to Massachusetts. The fle~~~~et al~~~~*et al*~~~~so operates in distant waters of the Atlantic including the central equatorial Atlantic Ocean and the Canadian Grand Banks. Fishing effort is reported in 11 defined fishing areas including the Gulf of Mexico. During 2008, the majority of fishing effort in the Atlantic was reported in the Mid-Atlantic Bight (Virginia to New Jersey, 1,911 sets) and the South Atlantic Bight (Georgia to North Carolina, 1,126 sets) fishing areas (Garrison *et al*. 2009).~~

~~Gear Characteristics: The pelagic longline gear consists of a mainline of >700 lb test monofilament typically ranging between 10 and 45 miles long. At regular intervals along the mainline, bullet shaped floats are suspended and long sections of the gear are marked by "high-flyers" or radio beacons. Suspended from the mainline are long gangion lines of 200 to 400 lb test monofilament that are typically 100 to 200 feet in length. Fishing depths are most typically between 40 and 120 feet. Hooks of various sizes are attached by a steel swivel leader. Longline sets~~

~~targeting tunas are typically set at dawn and soak throughout the day with recovery near dusk. Those sets targeting swordfish are more typically night sets. The total amount of time the gear remains in the water including set, soak, and haul times is typically 10-14 hours. As a result of a recent Biological Opinion on interactions between Atlantic longline gear targeting Tunas and Swordfish and endangered sea turtles, a comprehensive change in the fishing gear occurred in the longline fishery. After August 2004, only circle shaped hooks of 16/0 or 18/0 size can be used throughout the fishery.~~

~~Management and Regulations: The Large Pelagics Longline Fishery is listed as a Category I fishery under the MMPA due to frequently observed interactions with marine mammals in the 2012 List of Fisheries (76 FR 73912;November 29, 2011).(73 CFR 73066, December 1, 2008). The directed fishery is managed under the FMP for Atlantic Tunas, Swordfish, and Sharks (HMS FMP, 50 CFR Part 635) and the Pelagic Longline Take Reduction Plan. The fishery has also been the focus of management actions relating to bycatch of billfish. Amendment One to the Atlantic Billfish FMP also pertains to the Large Pelagics Longline Fishery and is consistent with the regulations in the HMS FMP. This fishery is also regulated under the Endangered Species Act resulting from frequent interactions with sea turtle species including both Loggerhead and Leatherback Turtles in the Atlantic and Gulf of Mexico. A Biological Opinion issued by the NMFS Southeast Regional Office in June 2004 mandated the use of circle hooks throughout the fishery, mandated the use of de-hooking and disentanglement gear by fishermen to reduce the mortality of captured sea turtles, reopened the Northeast Distant Water fishing area, and mandated increased reporting and monitoring of the fishery. As of 2009, the fishery also became managed under the Pelagic Longline Take Reduction Plan (http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-23349.pdf).~~

Observer Coverage: The Pelagic Longline Observer Program (POP) is a mandatory observer program managed by the SEFSC that has been in place since 1992. Observers are placed upon randomly selected vessels with total observer effort allocated on a geographic basis proportional to the total amount of fishing effort reported by the fleet. The target observer coverage level was 5% of reported sets through 2001, and was elevated to 8% of total sets in 2002. ~~Between 2000 and 2007, observer coverage as a percentage of reported sets in the Atlantic component of the fishery was 4, 4, 4, 7, 9, 6, 7, and 7. The observer coverage during 2007 was 7% of reported sets; however, coverage was often >10% in some areas and seasons (Garrison *et al.* 2009). These values do not include the experimental portion of the fishery in the Northeast Distant Water (NED) area, which was 100% of sets during 2001-2003.~~ In 2011, the overall percent observer coverage during regular fishing was 10.9% expressed as a proportion of reported hooks and 10.1% as a proportion of reported sets (Garrison and Stokes 2012). Observed longline sets and marine mammal interactions are shown for ~~2005~~2007-~~2009~~ 2011 in Figures 36 through ~~40~~45.

Comments: This fishery has been the subject of numerous management actions since 2000 associated with bycatch of both billfish and sea turtles. These changes have resulted in a reduction of overall fishery effort and changes in the behaviors of the fishery. The most significant change was the closure of the NED area off the Canadian Grand Banks and near the Azores as of June 1, 2001 (50 CFR Part 635). An experimental fishery was conducted in this area during both 2001 and 2002 to evaluate gear characteristics and fishing practices that increase the bycatch rate of sea turtles. Several marine mammals, primarily Risso's Dolphins, were seriously injured during this experimental fishery. In addition, there have been a number of time-area closures since late 2000 including year-round closures in the DeSoto Canyon area in the Gulf of Mexico and the Florida East Coast area; and additional seasonal closures in the Charleston Bump area and off of New Jersey (NMFS 2003). Additionally, a ban on the use of live fish bait was initiated in 1999 due to concerns over billfish bycatch. The June 2004 Biological Opinion has resulted in a significant change in the gear and fishing practices of this fishery that will likely impact marine mammal bycatch. The majority of interactions with marine mammals in this fishery have been with Pilot Whales and Risso's Dolphin. These interactions primarily occurred along the shelf break in the Mid-Atlantic Bight region during the third and fourth quarters (Garrison 2003; 2005; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007, Garrison *et al.* 2009). The Pelagic Longline Take Reduction Team was convened during 2005 to develop approaches to reduce the serious injury of pilot whales in the mid-Atlantic, and the resulting take reduction plan is currently being implemented by NOAA Fisheries (http://www.nmfs.noaa.gov/pr/pdfs/fr/fr74-23349.pdf).~~.~~

~~Protected Species Interactions: Documented interactions with Risso's dolphin, long-finned pilot whale, short-finned pilot whale, common dolphin, Atlantic spotted dolphin, pantropical spotted dolphin, bottlenose dolphin, dwarf or pygmy sperm whale, pygmy sperm whale, sperm whale, killer whale, Cuvier's beaked whale, Mesoplodon beaked whale, and northern bottlenose whale were reported in this fishery. Not mentioned here are documented interactions~~

~~with sea turtles and sea b~~

~~irds.~~

Southeast ~~ern U.S.~~ Atlantic ~~Shark~~ Gillnet

Current category: Category II

~~Target Species: Large and small coastal sharks including: Blacktip, Blacknose, Finetooth, Bonnethead, and Sharpnose Sharks~~

~~Number of Permit Holders: ~30~~

~~Number of Active Permit Holders: ~30~~

Basis for current classification on the LOF: Based on analogy to other Atlantic gillnet fisheries that use similar gear and operate in a similar manner to this fishery. Also, based on a 2001 recommendation by the Atlantic Scientific Review Group (SRG) to elevate all gillnet fisheries to Category II (unless there is evidence to the contrary).

Current list of marine mammal species/stocks injured/killed: Bottlenose dolphin, Southern Migratory coastal; Bottlenose dolphin, Central FL coastal; Bottlenose dolphin, Northern FL coastal; Bottlenose dolphin, SC/GA.

Gear description/method for fishing: This fishery uses gillnets set in sink, stab, set, or strike fashion.

Target species: This fishery targets finfish including, but not limited to: king mackerel, Spanish mackerel, whiting, bluefish, pompano, spot, croaker, little tunny, bonita, jack crevalle, cobia, and striped mullet.

Spatial/temporal distribution of effort: This fishery operates in waters south of a line extending due east from the North Carolina/South Carolina border and south and east of the fishery management council demarcation line between the Atlantic Ocean and the Gulf of Mexico. The majority of fishing effort occurs in Federal waters because South Carolina, Georgia, and Florida prohibit the use of gillnets, with limited exceptions, in state waters. This fishery does not include gillnet effort targeting sharks, which are a target species of the "Southeastern U.S. Atlantic shark gillnet fishery."

Management and regulations: Fishing for king mackerel, Spanish mackerel, cobia, cero, and little tunny in Federal waters is managed under the Coastal Migratory Pelagic Resources FMP. -None of the other target species are Federally managed under the Magnuson-Stevens Fishery Conservation and Management Act. -In state waters, state and Atlantic States Marine Fisheries Commission Interstate FMPs apply. -The fishery is also subject to BDTRP and ALWTRP implementing regulations (because of the potential for interactions with North Atlantic right whales in the Southeast U.S. Restricted Area).

Southeastern U.S. Atlantic Shark Gillnet Fishery

Current category: Category II

Basis for current classification on the LOF: -The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level.- When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after the new stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. -In this case, there is only one stock the killed/injured animals could have come from.

Current list of marine mammal species/stocks injured/killed (a (1)indicates those stocks driving the fishery's classification): Atlantic spotted dolphin, WNA; Bottlenose dolphin, Central Florida (FL) coastal (1); Bottlenose dolphin, Northern FL coastal; North Atlantic right whale, WNA.

Gear description/method for fishing: This fishery uses gillnets set in a sink, stab, set, strike, or drift fashion.

Mesh size is typically greater than 5 in (13 cm), but may be as small as 2.87 in (7.3 cm) when targeting small coastal sharks. -Drift gillnets most commonly use a mesh size of 5 in (13 cm), and average 10.2 hours from setting the gear through completion of haulback; sink gillnets most frequently use a mesh size of 7 in (18 cm), soaking for approximately 2.7 hours; and strike gillnets use the largest mesh size of 9 in (23 cm), soaking for approximately 0.8 hours.

Target species: Large and small coastal sharks (blacktip, blacknose, finetooth, bonnethead, and sharpnose).

Spatial/temporal distribution of effort: This fishery has traditionally operated in coastal waters off Florida and Georgia.

Management and regulations: This fishery is managed under the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (FMP), ALWTRP, and BDTRP. Regulations implemented under the Magnuson-Stevens Fishery Conservation and Management Act address managed target species, as well as bycatch species, including some protected under the ESA and Marine Mammal Protection Act (e.g., sea turtles, smalltooth sawfish, and right whales).

Total Effort: Gillnets targeting sharks in the southeastern U.S. Atlantic are fished in a variety of configurations including long soak drift sets, short soak encircling strike sets, and short duration sink sets. In addition, sink gillnets are used to target other finfish species. The same fishing vessels will fish the different types of sets. In the reported logbook data, it~~It~~ is difficult to identify these different gear types and distinguish sets targeting sharks from those targeting finfish. ~~in the reported logbook data.~~ The total amount of effort was therefore estimated based upon observer data and reported fishing gear and catch characteristics (Garrison 2007). Between 2001 and 2005, an annual average of 74 drift sets, 40 strike sets, and 241 sink sets targeting sharks were reported and/or observed. The number of drift sets has been declining steadily while the number of strike sets has been increasing. During 2006, there were 8 drift sets, 40 strike sets, and 301 sink sets targeting sharks reported or observed (Garrison 2007). However, there is direct evidence of under-reporting as some observed sets were not reported to the FLS system, and the total effort remains highly uncertain. In 2007, a total of 85 drift net sets were observed with 4 of those targeting sharks and the remainder Spanish mackerel.~~-~~ A total of 112 sink net sets were observed, with 60 of those targeting sharks and the remainder targeting various fish species (Baremore *et al.* 2007). During 2008, there was very limited targeted fishing for sharks off the coast of Florida due to the closure of the large coastal shark fishery during the first half of the year, and there were no strike sets observed targeting sharks and only a few sink sets (Passerotti and Carlson 2009).

Levels of observer coverage each year: A dedicated observer program for the Shark Drift Gillnet Fishery has been in place since 1998. Since 2000, due to the provisions of the ALWTRP, observer coverage has been high during the winter months. However, due to limited funding, observer coverage outside of this period was generally low (less than 5%) prior to 2000, and has been increasing since. From 2001 to 2006, the annual observer coverage of the drift gillnet fishery was 68%, 85%, 50%, 66%, 58%, and 48%, respectively. -The annual coverage of the strike component from 2001 to 2006 was 63%, 86%, 72%, 81%, and 84%, respectively. ~~–~~The sink component of the fishery was observed in 2005 and 2006 with coverage levels of 10% and 22%, respectively. -However, given the uncertainties in the level of reported effort, these estimates of observer coverage are highly uncertain. -Due to these uncertainties, effort levels for the fishery and estimated observer coverage for 2007 and 2008 are not available.

~~Temporal and Spatial Distribution: The Shark Gillnet fleet operates primarily in the coastal waters of Florida and Georgia, but sink sets targeting sharks are reported as far north as Cape Hatteras, NC (Carlson and Bethea 2007; Garrison 2007). Prior to 2007, shark drift gillnet fishing was restricted under the ALWTRP off the coast of Georgia (from 32° N latitude) and Florida to 27° 51' N latitude between 15 November to 31 March. Outside of this season, the drift and strike fishing vessels operated primarily north of Cape Canaveral, Florida, and along the Georgia coast. In 2007, the restricted area was expanded under the ALWTRP to include the area between 32° N latitude west of 80° W longitude and within 35 nautical miles of the South Carolina coast (Southeast U.S. Restricted Area North) with a closure to all gillnet gear from November 15 to April 15. The area between 29° N latitude and 27° 51' N latitude west of 80° W longitude (Southeast U.S. Restricted Area South) is also closed to gillnetting from December 1 through March 31, but fishing for shark is permitted with limited exemptions if special provisions are met (72 FR 34632, June 25, 2007).~~

~~Gear Characteristics: Historically, shark drift gillnet fishing was characterized by large mesh (5-10 inches) nets that wereare typically greater than 1500 feet long withand have long, night time soak durations exceeding 10 hours. However, in recent years, an increasing proportion of the fishing effort consists of "strike sets" in which schools of sharks are targeted and encircled. Strike sets are of much shorter duration (typically < 1 hour) than drift sets, have largelarge mesh sizes, and use deep fishing nets (Carlson and Bethea 2007). Sink nets typically use smaller mesh sizes than strike nets, the nets are shallower and shorter, and the soak duration average approximately 2 hours (Garrison 2007). Likewise, large mesh, long soak time drift net fishing has largely ended. Drift gillnets targeting sharks (observed off the coast of North Carolina) are of much shorter duration with total fishing times averaging less than 3 hours (Passerotti and Carlson 2009).~~

~~Management and Regulations: The Southeastern U.S. Atlantic Shark Gillnet Fishery is listed as a Category II fishery under the MMPA due to occasional interactions with marine mammals in the 2012 List of Fisheries (76 FR 73912;November 29, 2011).(74 FR 58859, November 16, 2009). The directed fishery effort is managed under an amendment to the HMS FMP (50 CFR Part 635, 66 FR 17370 March 30, 2001) that mandates observer coverage outside of the season, defined by the ALWTRP, at levels sufficient to achieve precise estimates (coefficient of variation < 0.3) of marine mammal and sea turtle bycatch. The fishery is also managed under the ALWTRP (50 CFR Part 229.32) and the Bottlenose Dolphin Take Reduction Plan (BDTRP).. The ALWTRP includes seasonal restriction of gillnet fishing in the Southeast U.S. Restricted Area North, special provisions for shark gillnet gear in the Southeast U.S. Restricted Area South, including 100% observer coverage, and the use of Vessel Monitoring Systems (VMS) in lieu of 100% observer coverage for shark gillnets with webbing of 5" or greater stretched mesh in the newly created Southeast U.S. Monitoring Area (72 FR 57104, October 5, 2007) , and restrictions on setting shark gillnets with webbing of 5" or greater stretched mesh 3 nm from large whales in the newly created Other Southeast Gillnet Waters. Similar provisions are also included in the Biological Opinion on the fishery under section 7 of the Endangered Species Act.~~

~~Observer Coverage: A dedicated observer program for the Shark Drift Gillnet Fishery has been in place since 1998. Due to the provisions of the ALWTRP, observer coverage has been high during winter months since 2000. However, due to limits on available resources, observer coverage outside of this period was generally low (< 5%) prior to 2000 but has been increasing during the last several years. In 2005, the observer program was expanded to include a limited number of sink gillnets targeting both fish and sharks (Carlson and Bethea 2007). Due to the difficulties in identifying the reported effort, the percentage of observer coverage by gear type is difficult to quantify. From 2001 to 2006, the percent annual observer coverage of the drift gillnet fishery was 68, 85, 50, 66, 58, and 48, respectively. The percent annual coverage of the strike component from 2001 to 2006 was 63, 86, 72, 81, and 84, respectively. The sink component of the fishery was observed in 2005 and 2006 with coverage levels of 10% and 22%, respectively. However, given the uncertainties surrounding the level of reported effort in the FLS, these estimates of observer coverage are highly uncertain (Garrison 2007). Due to these uncertainties, and continuing changes in the execution and observer coverage of the fishery, effort levels for the fishery and estimated observer coverage for 2007 and 2008 are not available. The locations of observed strike, drift, and sink sets in the shark gillnet fishery are shown in Figures 41-45. There have been no observed marine mammal interactions since 2003.~~

Comments: There is a significant level of uncertainty surrounding estimating the total level of effort in this fishery. There is direct evidence of inconsistency in reporting. It is not possible to reliably distinguish trips targeting sharks from those targeting other fish species, and it is not possible to distinguish different types of sets in the logbook data. However, the overall marine mammal and sea turtle bycatch rate is very low, therefore it is unlikely that even severe biases would result in large increases in the estimated total protected species bycatch in this fishery. In addition to marine mammal interactions, this fishery has been the subject of management concern due to recent interactions with endangered sea turtles including leatherback~~Leatherback~~ and loggerhead turtles~~Loggerhead Turtles~~.

~~Protected Species Interactions: Documented interactions with coastal bottlenose dolphin and Atlantic spotted dolphin were reported in this fishery. There are two documented cases of possible interactions between North Atlantic right whales and the shark drift gillnet fishery off the Florida coast.~~

Atlantic Blue Crab Trap/Pot

Current category: Category II

Basis for current classification on the LOF: The total annual mortality and serious injury West Indian manatees (FL stock) in this fishery is greater than 1% and less than 50% of the stocks' Potential Biological Removal (PBR) level. -Also, when the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks. -The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) and NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): –Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Southern NC estuarine system (1); Bottlenose dolphin, Charleston estuarine system (1); Bottlenose dolphin, Northern Georgia (GA)/Southern South Carolina (SC) estuarine system (1); Bottlenose dolphin, Southern GA estuarine system (1); Bottlenose dolphin, Jacksonville estuarine system (1); Bottlenose dolphin, Indian River Lagoon estuarine system (1); Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Southern Migratory coastal (1); Bottlenose dolphin, Northern Florida (FL) coastal (1); Bottlenose dolphin, Central FL coastal (1); Bottlenose dolphin, SC/GA coastal (1); West Indian manatee, FL (1)
.~~Target Species: Atlantic blue crab~~

~~Number of Permit Holders: As of 2011, the fishery was estimated to have approximately 7,734 permits. This~~~~The Blue Crab Trap/Pot Fishery is likely an overestimate due to the fact that the state of Florida does not differentiate permits for blue crab between the Gulf and Atlantic coast.~~

~~Temporal and Spatial Distribution: The fishery occurs year-round from the south shore of Long Island at 72° 30'W. long. in the Atlantic and east of the fishery management demarcation line between the Atlantic Ocean and the Gulf of Mexico (50 CFR 600.105), including~~~~broadly distributed in estuarine and nearshore coastal waters throughout the mid and south Atlantic.~~

Gear description/method for fishing: This fishery uses pots baited with fish or poultry typically set in rows in shallow water. The pot position is marked by a buoy line attached to a surface buoy.
~~Gear Characteristics: The fishery is estimated to have 6,479 participants deploying gear on a year-round basis. Pots are baited with fish or poultry and are typically set in shallow water. The pot position is marked by either a floating or sinking buoy line attached to a surface buoy.~~

Target species: Blue crab.

Spatial/temporal distribution of effort: The fishery occurs year-round from the south shore of Long Island at 72° 30'W. long. in the Atlantic and east of the fishery management demarcation line between the Atlantic Ocean and the Gulf of Mexico (50 CFR 600.105), including state waters.

Management and Regulations: The fishery is defined as a Category II fishery in the 2012 List of Fisheries (76 FR 73912; November 29, 2011). It is managed under state Fishery Management Plans, the Bottlenose Dolphin Take Reduction Plan, and Atlantic Large Whale Take Reduction Plan.

~~Protected Species Interactions: Bottlenose dolphin, Northern North Carolina (NC) eEstuarine sSystem; Bottlenose dolphin, Southern NC eEstuarine sSystem; Bottlenose dolphin, Charleston eEstuarine sSystem; Bottlenose dolphin, Northern Georgia (GA)/Southern South Carolina (SC) eEstuarine sSystem; Bottlenose dolphin, Southern GA eEstuarine sSystem; Bottlenose dolphin, Jacksonville eEstuarine sSystem; Bottlenose dolphin, Indian River Lagoon eEstuarine sSystem; Bottlenose dolphin, Northern Migratory eCoastal; Bottlenose dolphin, Southern Migratory eCoastal; Bottlenose dolphin, Northern Florida (FL) eCoastal; Bottlenose dolphin, Central FL eCoastal; Bottlenose dolphin, SC/GA eCoastal; West Indian manatee, FL~~

Comments:
-In recent years, reports of strandings with evidence of interactions between bottlenose dolphins and both recreational and commercial crab pot fisheries have been increasing in the Southeast region (McFee and Brooks

1998; Burdett and McFee 2004). Interactions with crab pots appear to generally involve a dolphin becoming wrapped in the buoy line. The total number of these interactions and associated mortality rates has not been documented~~,~~; however, based on stranding data from 2004~~2~~-20~~08~~11, there have been ~~1~~23 reports of interactions between bottlenose dolphins and Atlantic blue crab trap/pot gear~~,~~. From 2002 to 2011, there were an additional ~~and 4~~13 interactions in the Atlantic ocean that were a result of pot fisheries that could not be definitively identified to a specific fishery~~.~~ ~~but from 2002-2007, SEFSC stranding data show 5 confirmed bottlenose dolphin mortalities due to interactions with blue crab pot gear and 11 bottlenose dolphin disentanglements with live releases.~~ ~~There are also documented interactions with the West Indian manatee, Florida stock. The fishery has been defined as a Category II fishery in the 2011 List of Fisheries (75 FR 68468, November 8 , 2010). It is managed under the Bottlenose Dolphin Take Reduction Plan and the Atlantic Large Whale Take Reduction Plan.~~

Mid-Atlantic Haul/Beach Seine

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Southern Migratory coastal (1).

Gear description/method for fishing: This fishery uses seines with one end secured (e.g., swipe nets and long seines); both ends secured; or those anchored to hauled up on the beach. The beach seine system is generally constructed of a wash, wing, and bunt that are attached to the beach and extend into the surf and are traditionally used to encircle or encompass fish. The fishery occurs in waters west of 72° 30′ W. long. and north of a line extending due east from the North Carolina/South Carolina border. The only haul/beach seine gear operating in North Carolina included in this Category II fishery is the ''Atlantic Ocean striped bass beach seine fishery'' during the winter, as regulated by North Carolina Marine Fisheries Commission rules (NCDMF) and NCDMF proclamations. NCDMF defines a beach seine operating under the Atlantic Ocean Striped Bass beach seine fishery as a ''swipe net constructed of multifilament, multifiber webbing fished from the ocean beach that is deployed from a vessel launched from the ocean beach where the fishing operation takes place, and one end of the beach seine is attached to the shore at all times during the operation.'' All other NC small and large mesh beach- anchored gillnets with webbing constructed of all monofilament material or a combination of monofilament and multifilament.

Target Species: Striped bass, mullet, spot, weakfish, sea trout, bluefish, kingfish, and harvestfish.

~~Number of Permit Holders: 874~~

Spatial/temporal distribution of effort: This fishery operates in waters west of 72° 30'W. long. and north of a line extending due east from the North Carolina/South Carolina border and includes haul seining in other areas of the mid-Atlantic, including Virginia, Maryland, and New Jersey. The North Carolina Atlantic Ocean Striped Bass fishery operates primarily along the Outer Banks using small and large mesh nets and primarily during the fall and winter months. ~~Temporal and Spatial Distribution: The fishery occurs in waters west of 72° 30′ W. long. and north of a line extending due east from the North Carolina/South Carolina border.~~

~~Gear Characteristics: This fishery uses seines with one end secured (e.g., swipe nets and long seines); both ends secured; or those anchored to hauled up on the beach. The beach seine system is generally constructed of a wash, wing, and bunt that are attached to the beach and extend into the surf and are traditionally used to encircle or encompass fish. The only haul/beach seine gear operating in North Carolina included in this Category II fishery is the ''Atlantic Ocean striped bass beach seine fishery'' during the winter, as regulated by North Carolina Marine~~

Fisheries Commission rules (NCDMF) and NCDMF proclamations. NCDMF defines a beach seine operating under the Atlantic Ocean Striped Bass beach seine fishery as a ''swipe net constructed of multifilament, multifiber webbing fished from the ocean beach that is deployed from a vessel launched from the ocean beach where the fishing operation takes place, and one end of the beach seine is attached to the shore at all times during the operation.''

Observer Coverage: –North Carolina beach-based fishing has been observed since April 7, 1998 by the NMFS Fisheries Sampling Program (Observer Program) based at the NEFSC. The numbers of observed beach seine sets from 1998 to 2008 were 63, 60, 52, 12, 6, 23, 36, 29, 9, 27, and 39.

Management and Regulations: The fishery is managed under several state and Interstate Fishery Management Plans and is an affected fishery under the BDTRP. Large mesh nets are regulated in North Carolina via North Carolina Marine Fisheries Commission rules and NCDMF proclamations. The fishery is defined as a Category II fishery in the 2012 List of Fisheries (76 FR 73912; November 29, 2011).

Observer Coverage: –North Carolina beach-based fishing has been observed since April 7, 1998 by the NMFS Fisheries Sampling Program (Observer Program) based at the NEFSC and the North Carolina Alternate Platform Observer Program. The numbers of observed beach seine sets from 1998 to 2008 were 63, 60, 52, 12, 6, 23, 36, 29, 9, 27, and 39. Overall, there has been very limited observer coverage by the NEFSC and the NC Alternate Platform Observer program.

Protected Species Interactions:
Bottlenose dolphin, Northern North Carolina (NC) eEstuarine sSystem; Bottlenose dolphin, Northern Migratory cCoastal; Bottlenose dolphin, Southern Migratory cCoastal.

This beach-based fishery operates primarily along North Carolina's Outer Banks using small and large mesh gillnets. Small mesh gillnets are generally used in the spring and fall to target gray trout (weakfish), speckled trout, spot, kingfish (sea mullet), bluefish, and harvest fish (star butters). Large mesh gillnets are used to target Atlantic striped bass during the winter and are regulated via North Carolina Fisheries rules and proclamations. Small mesh nets are generally constructed in the manner of a beach seine, although the net material is a combination of multifilament and monofilament. The beach seine system uses a bunt and a wash net that is attached to the beach and fished in the surf (Steve *et al.* 2001). Conversely, large mesh nets are constructed of all monofilament material and generally used to fish during the Atlantic Ocean striped bass beach seine fishery. Although construction and characteristics of large and small mesh nets differ, they are set and hauled similarly. Nets are deployed out of the stern of the surf dories and set perpendicular to the shoreline. A truck is generally used to haul the net ashore by attaching one end of the net to the truck and pulling it ashore while the other end remains fixed until the end of the haul. North Carolina Division of Marine Fisheries (NCDMF) finalized regulations in October 2008 requiring fishermen participating in the Atlantic Ocean striped bass beach seine fishery to use nets constructed of all multifilament material (NCDMF Proclamation FF-51-2008), thereby moving closer to the traditional manner of beach seine fishing for large mesh nets. Small mesh nets are not included under NCDMF's regulations for the Atlantic Ocean striped bass beach seine fishery, and therefore, still operate more in the manner of gillnets rather than beach seines because of their construction with monofilament material and fishing practices. Subsequently, they are listed as a Category I Mid-Atlantic Gillnet fishery in the 2011 List of Fisheries (75 FR 68468, November 8, 2010). Therefore, the Atlantic Ocean striped bass beach seine fishery using large mesh gillnets is now the only fishery included under the Mid-Atlantic Haul/Beach Seine Fishery for North Carolina. The Mid-Atlantic Haul/ Beach Seine Fishery (NC only) is listed as a Category II fishery in the 2010 List of Fisheries (75 FR 68468, November 8, 2010). North Carolina beach-based fishing has been observed since April 7, 1998 by the NMFS Fisheries Sampling Program (Observer Program) based at the NEFSC. The numbers of observed beach seine sets from 1998 to 2008 were 63, 60, 52, 12, 6, 23, 36, 29, 9, 27, and 39. This fishery has observed interactions with estuarine and coastal bottlenose dolphins and is managed under the Bottlenose Dolphin Take Reduction Plan .

North Carolina Inshore Gillnet Fishery

Target Species: Include, but are not limited to southern flounder, weakfish, bluefish, Atlantic croaker, striped mullet, spotted seatrout, Spanish mackerel, striped bass, spot, red drum, black drum, and shad.

Number of Permit Holders: 2,250

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern North Carolina (NC) estuarine (1); Bottlenose dolphin, Southern NC estuarine (1).

Gear description/method for fishing: This fishery includes any fishing effort using any type of gillnet gear, including set (float and sink), drift, and runaround gillnet.

Target species: Target species include, but are not limited to: southern flounder, weakfish, bluefish, Atlantic croaker, striped mullet, spotted seatrout, Spanish mackerel, striped bass, spot, red drum, black drum, and shad.

Temporal and Spatial Distribution: This fishery includes any gillnet effort for any target species inshore of the COLREGS demarcation lines in North Carolina (COLREGS demarcation lines delineate those waters upon which mariners shall comply with the International Regulations for Preventing Collisions at Sea and those waters upon which mariners shall comply with the Inland Navigation Rules).

~~Gear Characteristics: This fishery includes any fishing effort using any type of gillnet gear, including set (float and sink), drift, and runaround gillnet.~~

Management and Regulations: This fishery is managed under state and Interstate Fishery Management Plans, applying net and mesh size regulations, and seasonal area closures in the Pamlico Sound Gillnet Restricted Area. It is an affected fishery under the BDTRP. The fishery is defined as a Category II fishery in the 2012 List of Fisheries (76 FR 73912; November 29, 2011).

Observer Coverage: Observer coverage, up to 10% in some cases, is provided by the North Carolina Division of Marine Fisheries, primarily during the fall flounder fishery in Pamlico Sound. The Northeast Fishery Observer Program has observed the fishery at low levels, as well as the North Carolina Alternative Platform Observer Program.

~~Management and Regulations: This fishery is managed under state and Interstate Fishery Management Plans, applying net and mesh size regulations, and seasonal area closures in the Pamlico Sound Gillnet Restricted Area. It is an affected fishery under the BDTRP. The fishery is defined as a Category II fishery in the 2012 List of Fisheries (76 FR 73912; November 29, 2011).~~

~~Protected Species Interactions: Bottlenose dolphin, Northern North Carolina Estuarine System; Bottlenose dolphin, Southern North Carolina Estuarine System.~~

North Carolina Long Haul Seine

~~The Long Haul Seine is an estuarine fishery operating in North Carolina waters with 372 permits. The fishery includes fishing with long haul seine gear to target any species in waters off North Carolina, including estuarine waters in Pamlico and Core Sounds and their tributaries10-15 participants statewide. The seine consists of a 1000-1200 yard long net pulled by two boats for distances of 1-2 nautical miles (Steve *et al.* 2001). Fish are encircled by pulling the net around a fixed stake. The fishery targets Weakfish, Spot, Croaker, Menhaden, Bluefish, Spotted Seatrout, and Hagfish, and operates in Pamlico and Core sounds and tributaries. The fishery operates primarily between June and October. Occasional interactions with estuarine and coastal bottlenose dolphins have been reported. The fishery ishas been defined as a Category II fishery in the 20122011 List of Fisheries (76 FR~~

~~73912;November 29, 2011)(75 FR 68468, November 8, 2010) and is managed under the Bottlenose Dolphin Take Reduction Plan.~~
Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after the new stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. In this case, there is only one stock the killed/injured animals could have come from.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern North Carolina (NC) estuarine system (1); Bottlenose dolphin, Southern NC estuarine system.

Gear description/method for fishing: This fishery uses multi-filament seines consisting of a 1,000-2,000 yard (3,000-6,000 ft) net pulled by two boats for 1-2 nmi (2-4 km). Fish are encircled and concentrated by pulling the net around a fixed stake.

Target species: This fishery targets species including, but not limited to: weakfish, spot, croaker, menhaden, bluefish, spotted seatrout, and hogfish

Spatial/temporal distribution of effort: The fishery includes fishing with long haul seine gear to target any species in waters off North Carolina, including estuarine waters in Pamlico and Core Sounds and their tributaries. The fishery occurs from February-November, with peak effort occurring from June-October.

Management and regulations: The fishery is managed under Atlantic States Marine Fisheries Commission Interstate Fishery Management Plans, and is an affected fishery under the BDTRP.

Levels of observer coverage each year: There has not been observer coverage in this fishery.

North Carolina Roe Mullet Stop Net

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than 1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after the new stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. In this case, there is only one stock the killed/injured animals could have come from.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Southern North Carolina (NC) estuarine system (1).

Gear description/method for fishing: This fishery uses a stop net and a beach seine. The stop net is a stationary, multi-filament net set in an "L" shape that is anchored to the beach and extended out perpendicular to the beach. The stop net herds schools of fish, while the beach haul seine is used to capture fish and bring them ashore. The beach seine is constructed of multi-filament and monofilament panels with stretched mesh ranging from 3-4 inches stretched. The stop net is traditionally left in the water for 1-5 days, but can be left as long as 15 days.

Target species: Striped mullet.

Spatial/temporal distribution of effort: Effort occurs from October-November and is unique to Bogue Banks, North Carolina.

Management and regulations: -This fishery is managed under the North Carolina Striped Mullet Fishery Management Plan, North Carolina Department of Marine Fisheries, and is an affected fishery under the BDTRP.

Levels of observer coverage each year: There has not been Federal observer coverage in this fishery; however, the NMFS Beaufort laboratory observed this fishery in 2001-2002.

The Stop Net Fishery is unique to Bogue Banks, North Carolina with approximately 13 participants.. The gear consists of a stationary, multi-filament anchored net extended perpendicular to the beach to stop the alongshore migration of Striped Mullet. Once the catch accumulates near the end of the stop net, a beach haul seine is used to capture fish and bring them ashore. The stop net is traditionally left in the water for 1 to 5 days during the fishery season from October to November, but can be left as long as 15 days (Steve *et al.* 2001). Interactions between this fishery and estuarine and coastal bottlenose dolphins have been reported; however, the total number of interactions has not been estimated. There has not been Federal observer coverage in this fishery; however, the NMFS Beaufort laboratory observed this fishery in 2001-2002. The fishery is defined as a Category II fishery in the 2012 List of Fisheries (76 FR 73912;November 29, 2011)The fishery has been defined as a Category II fishery in the 2011 List of Fisheries (75 FR 68468, November 8, 2010) and is managed under the Bottlenose Dolphin Take Reduction Plan.

Virginia Pound Net

Current category: Category II

Basis for current classification on the LOF: The 2010 LOF included a superscript "1" following bottlenose dolphin (WNA coastal stock) because the annual mortality and serious injury of that stock in this fishery was greater than1% and less than 50% of the stock's Potential Biological Removal (PBR) level. When the stocks of bottlenose dolphins killed/injured in this fishery were updated on the 2011 LOF, the superscript "1" was retained after each of these stocks because NMFS cannot yet differentiate to which stock a killed/injured animal belongs. Until NMFS is able to do so, each stock of bottlenose dolphin is considered to be driving the classification of the fishery.

Current list of marine mammal species/stocks injured/killed (a (1)indicates those stocks driving the fishery's classification): Bottlenose dolphin, Northern Migratory coastal (1); Bottlenose dolphin, Northern North Carolina (NC) estuarine system; Bottlenose dolphin, Southern Migratory coastal (1)
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Gear description/method for fishing: This fishery uses stationary gear. Pound net gear includes a large mesh lead posted perpendicular to the shoreline and extending outward to the corral, or "heart," where the catch accumulates.

Target species: Weakfish, spot, and croaker.

Spatial/temporal distribution of effort: Effort in this fishery occurs in nearshore coastal and estuarine waters off Virginia. This fishery includes all pound net effort in Virginia state waters, including waters inside the Chesapeake Bay.

Observer Coverage: Pound Nets are a stationary gear fished in nearshore coastal and estuarine waters of Virginia.. The gear consists of a large mesh lead posted perpendicular to the shoreline extending outward to the corral, or "heart", where the catch accumulates. Target species included Weakfish, Spot, Spanish mackerel, Bluefish,and Croaker. There has not been formal observer coverage in this fishery; however, the Northeast Fishery Observer Program (NEFOP) has monitoring and characterization that occurs sporadically in this fishery. —As of 2011, the fishery was estimated to have approximately 66 permits. The NEFOP began observing effort in this fishery in 2001.

Management and regulations: The fishery is managed by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plans for Atlantic Croaker and Spot, and is an affected fishery under the BDTRP.

Comments: In 2004 and 2005 an experimental fishery was conducted in an area of the Chesapeake Bay that was closed to commercial pound net fishing effort from May to July for sea turtle conservation. The results from these

studies determined a modified pound net leader could be used for pound net fishing while providing sea turtle conservation benefits. Occasional interactions with coastal bottlenose dolphins have been observed while monitoring for sea turtle interactions in both the commercial and experimental fisheries. Three takes of coastal bottlenose dolphins were observed in 2003, 2004, and 2009. Stranded bottlenose dolphins have also shown evidence of interactions with pound nets. From 2002 to 2009, 21 bottlenose dolphins were removed dead from Virginia pound nets, and 4 dolphins were disentangled alive (Sue Barco, Virginia Aquarium). Data from the Chesapeake Bay suggest that the likelihood of Bottlenose Dolphin entanglement in pound net leads may be affected by the mesh size of the lead net (Bellmund *et al.* 1997), but the information is not conclusive. A recent study conducted by Barco *et al.* in 2009 examined the use of modified pound net leaders adopted for sea turtle conservation because they believed it would also be effective in reducing bottlenose dolphin interactions in pound net leads. The study took place in the lower Chesapeake Bay and evaluated the effect of modified pound net leaders on finfish bycatch to ensure it maintained catch efficiency. Results show modified pound net leadersleader had similar or greater catches of finfish compared to traditional leaders (e.g., leaders that were not modified for sea turtle conservation). The fishery ishas been defined as a Category II fishery in the 20122011 List of Fisheries (76 FR 73912;November 29, 2011)(75 FR 68468, November 8, 2010) and is managed under the Bottlenose Dolphin Take Reduction Plan .

Mid-Atlantic Menhaden Purse Seine

Fishing gear type: Purse seine

Current category: Category II

Basis for current classification on the LOF: Based on analogy to other purse seine fisheries, such as the Category II Gulf of Mexico Menhaden purse seine fishery, and potential interactions with bottlenose dolphins (Northern Migratory coastal and Southern Migratory coastal stocks).

Current list of marine mammal species/stocks injured/killed: Bottlenose dolphin, Northern Migratory coastal; Bottlenose dolphin, Southern Migratory coastal.

Gear description/method for fishing: This fishery uses purse seine gear for reduction or baitfish. The purse seine net is made of nylon fiber and is about 1 ¾ inch stretched mesh; net length is about 1,000-1,400 ft; and net depth is from 65-90 ft. Soak time is approximately 35-45 minutes from deployment of net until the purse is closed. Fishing vessels are either large (up to 200 ft) carrying two smaller purse seine boats (39 ft), or small snapper rigs (60-75 ft).Schools of menhaden are spotted from larger vessels and/or spotted planes. Purse seines are deployed over schools vertically from large vessel or two smaller boats. The floatline and leadline has a series of rings threaded with a purse line that is winched closed around the school. The net is retrieved by power block.

Target species: Menhaden and thread herring.

Spatial/temporal distribution of effort: Most sets occur within 3 mi (4.8 km) of shore with the majority of the effort occurring off North Carolina from November-January, and moving northward during warmer months to southern New England. Fishing effort is year-round with concentrated migratory peaks from May-September from Virginia northward, and November-January in North Carolina. A majority of the fishing effort by the Virginia fleet occurs in the Virginia portion of Chesapeake Bay, and along the ocean beaches of Eastern Shore Virginia. Most sets in Chesapeake Bay are in the main stem of the Bay, greater than one mile from shore. In summer, the Virginia fleet occasionally ranges as far north as northern New Jersey. Purse-seining for reduction purposes is prohibited by state law in Maryland, Delaware, and New Jersey; hence, purse-seine sets in the ocean off Delmarva and New Jersey are by definition greater than 3 miles from shore.

Levels of observer coverage each year: There has been very limited observer coverage since 2008.

Management and regulations: The fishery is managed by the Atlantic States Marine Fisheries Commission under the Interstate Fishery Management Plan for Atlantic Menhaden.
Between 1994 and 1997, about 18-20 menhaden purse seine vessels for reduction operated out of two processing

facilities in Chesapeake Bay at Reedville, Virginia.. Another fleet of vessels 2-5 vessels operated out of a smaller processing facility at Beaufort, North Carolina. Since 1998, only one plant has been operational in Virginia with a total fleet of about 10 vessels. Between 1998 and 2004 the factory at Beaufort operated with 2-3 vessels. After the 2004 fishing season, the factory at Beaufort closed permanently. A majority of the fishing effort by the Virginia fleet occurs in the Virginia portion of Chesapeake Bay, and along the ocean beaches of Eastern Shore Virginia. As of 2011, there are 56 participants. Most sets in Chesapeake Bay are in the main stem of the Bay, greater than one mile from shore. In summer, the Virginia fleet occasionally ranges as far north as northern New Jersey. Purse seining for reduction purposes is prohibited by state law in Maryland, Delaware, and New Jersey; hence, purse seine sets in the ocean off Delmarva and New Jersey are by definition greater than 3 miles from shore. The Virginia fleet ranges south into NC coastal waters during November and December, but this segment of the fishery is highly weather-dependent. Large vessels (up to 200 ft) carrying two small purse seine boats are used for fishing effort, with some smaller vessels (called snapper rigs) about 606-75 feet in length. Schools of menhaden are generally spotted from larger vessels and/or spotter planes. The purse seine is deployed over the school vertically from the large vessel or the two smaller boats. The net floatline and leadline has a series of rings threaded with a purse line that is winched closed around the school, and the net is retrieved by power block. The purse seine net is made of nylon fiber with a bar mesh from ¾ to 7/8 inch (about 1-3/4 inch stretched mesh). Net length ranges from 1,000-1,400 feet, with a net dept averaging 65-90 feet. Occasional interactions with coastal bottlenose dolphins have been recorded historically in this fishery. In 2008 and 2009, there was very limited observer coverage; however, there was no systematic coverage prior to these years and the level of incidental interactions with marine mammals is undocumented. The Mid-Atlantic Menhaden Purse Seine Fishery ishas been defined as a Category II fishery in the 20122011 List of Fisheries (76 FR 73912;November 29, 2011)(75 FR 68468, November 8, 2010) and is affectedwill be managed under the Bottlenose Dolphin Take Reduction Plan..

Southeastern U.S. Atlantic/Gulf of Mexico Shrimp Trawl

Current category: Category II

Basis for current classification on the LOF: Based on interactions reported through observer reports, stranding data, and fisheries research data, with multiple strategic and non-strategic marine mammal stocks. Due to the lack of PBR data for most of the stocks and the low observer coverage in this fishery, NMFS conducted a qualitative analysis to determine the appropriate classification for this fishery. Even with low coverage, NMFS observed 12 dolphin takes (of which 11 were serious injuries or mortalities) since 1993; 11 of which were taken since 2002. Also, the final 2009 SARs note that "occasional interactions with bottlenose dolphins have been observed.. and there is infrequent evidence of interactions from stranded animals." Further, Marine Mammal Authorization Program (MMAP) records list 1 dolphin take in shrimp trawl gear in South Carolina in 2002. Lastly, 13 dolphin takes, 10 of which were taken since 2002, have been documented by NMFS in Southeast U.S. research trawl operations, and/or relocation trawls conducted.

Current list of marine mammal species/stocks injured/killed (a (1) indicates those stocks driving the fishery's classification): Atlantic spotted dolphin, Gulf of Mexico (GMX) continental and oceanic; Bottlenose dolphin, GMX continental shelf; Bottlenose dolphin, Northern GMX coastal; Bottlenose dolphin, South Carolina/Georgia (SC/GA) coastal (1); Bottlenose dolphin, Eastern GMX coastal (1); Bottlenose dolphin, Western GMX coastal (1); Bottlenose dolphin, GMX bay, wound, estuarine (1); West Indian manatee, Florida (FL).

Gear description/method for fishing: The most commonly employed gear in this fishery is a double-rig otter trawl, which normally includes a lazy line attached to each bag's codend. The lazy line floats free during active trawling, and as the net is hauled back, it is retrieved with a boat- or grappling-hook to assist in guiding and emptying the trawl nets. Shrimp trawl soak time is about three hours.

Target species: Brown, pink and white shrimp within estuaries, and near coastal and offshore regions. Royal Red shrimp along the deep continental slope.

Spatial/temporal distribution of effort: The pelagic or bottom trawl fishery operating virtually year-round in the Atlantic Ocean from NC through FL, and in the Gulf of Mexico from FL through TX. Effort occurs in estuarine, near shore coastal waters, and along the continental slope of the Atlantic and estuarine, near shore coastal, and offshore continental shelf and slope waters in the Gulf of Mexico. Fishery typically operates from sunset to sunrise

when shrimp are most likely to swim higher in the water column.

Management and regulations: Although shrimp trawlers are required under Endangered Species Act regulations to use turtle excluder devices to reduce sea turtle bycatch (50 CFR 223.206), the fishery currently does not use any method or gear modification to deter, or reduce bycatch of, marine mammals. -The shrimp trawl fishery is affected under the Bottlenose Dolphin Take Reduction Plan.

Levels of observer coverage each year: -This fishery was observed between 1992 and 2006 under a voluntary program, which became mandatory in 2007. -Observer coverage was less than 1% for all observed years.

~~The Shrimp Trawl Fishery operates from North Carolina through the Texas coast virtually year-round, moving seasonally up and down the coast. A recent estimate of fishing effort based upon state dealer trip reports included approximately 23,000 shrimping trips (Epperly *et al.* 2002). As of 2010, there were an estimated 5,000 participants. The most commonly employed gear in this fishery is a double-rig otter trawl, which normally includes a lazy line attached to each bag's codend. The lazy line floats free during active trawling, and as the net is hauled back, it is retrieved with a boat- or grappling hook to assist in guiding and emptying the trawl nets. Shrimp trawl soak time is about three hours. 2002). The gear consists of relatively fine-meshed trawls typically fished in a paired fashion on either side of a fishing vessel. Effort occurs in both estuarine and nearshore coastal waters. The Shrimp Trawl Fishery has long been the focus of management actions associated with significant bycatch of both fish species and sea turtles. Observer coverage was historically very sparse and non-systematic. However, in 2007, the observer coverage expanded and became mandatory for fishing vessels to take an observer if selected. Observer coverage currently averages about 1% of the total fishery effort. Occasional interactions with bottlenose dolphins have been observed in the Atlantic and Gulf of Mexico, and there is infrequent evidence of interactions from stranded animals. NMFS observed 12 dolphin takes (of which 11 were serious injuries or mortalities) since 1993; 11 of which were taken since 2002. Further, Marine Mammal Authorization Program (MMAP) records list 1 dolphin take in shrimp trawl gear in South Carolina in 2002. Lastly, 13 dolphin takes, 10 of which were taken since 2002, have been documented by NMFS in Southeast U.S. research trawl operations, and/or relocation trawls conducted. The Shrimp Trawl fishery is defined as a Category II fishery in the 2012 List of Fisheries (76 FR 73912;November 29, 2011), and is therefore, affected under the Bottlenose Dolphin Take Reduction Plan in the Atlantic portion of its range. During 1993-2008, 6 unidentified dolphins and 3 bottlenose dolphins were observed dead in shrimp fishery vessels. The animals were caught in water depths between 7 and 87 m. The unidentified animals were likely either bottlenose dolphins or Atlantic spotted dolphins based upon location and depth. In 2008, an additional dolphin carcass was caught on the tickler of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. This cannot be confirmed without a necropsy. Additionally, in 2002, a fisherman self-reported a take of an unidentified dolphin. The Shrimp Trawl fishery has been defined as a Category II fishery in the 2011 List of Fisheries (75 FR 68468, November 8, 2010).~~

III. Historical Fishery Descriptions

Atlantic Foreign Mackerel

Prior to 1977, there was no documentation of marine mammal bycatch in DWF activities off the Northeast coast of the U.S. With implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA) in that year, an Observer Program was established which recorded fishery data and information on incidental bycatch of marine mammals. DWF effort in the U.S. Atlantic Exclusive Economic Zone (EEZ) under MFCMA had been directed primarily towards Atlantic Mackerel and Squid. From 1977 through 1982, an average mean of 120 different foreign vessels per year (range 102-161) operated within the U.S. Atlantic EEZ. In 1982, there were 112 different foreign vessels; 16%, or 18, were Japanese Tuna longline vessels operating along the U.S. east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1991, the numbers of foreign vessels operating within the U.S. Atlantic EEZ each year were 67, 52, 62, 33, 27, 26, 14, 13, and 9 respectively. Between 1983 and 1988, the numbers of DWF vessels included 3, 5, 7, 6, 8, and 8 respectively, Japanese longline vessels. Observer coverage on DWF vessels was 25-35% during 1977-1982, and increased to 58%, 86%, 95% and 98%, respectively, in 1983-1986. One hundred percent observer coverage was maintained during 1987-1991. Foreign fishing operations for Squid ceased at the end of the 1986 fishing season and for Mackerel at the end of the 1991 season. Documented interactions with white sided dolphins were reported in this fishery.

Pelagic Drift Gillnet

In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. The fishery operated during 1998. Then, in January 1999 NMFS issued a Final Rule to prohibit the use of drift net gear in the North Atlantic Swordfish Fishery (50 CFR Part 630). In 1986, NMFS established a mandatory self-reported fisheries information system for Large Pelagic Fisheries. Data files are maintained at the SEFSC. The estimated total number of hauls in the Atlantic Pelagic Drift Gillnet Fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls from 1991 to 1996 was 233, 243, 232, 197, 164, and 149 respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. In 1994 to 1998 there were 11, 12, 10, 0, and 11 vessels, respectively, in the fishery. Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994, 99% in 1995, 64% in 1996, no fishery in 1997, and 99% coverage during 1998. Observer coverage dropped during 1996 because some vessels were deemed too small or unsafe by the contractor that provided observer coverage to NMFS. Fishing effort was concentrated along the southern edge of Georges Bank and off Cape Hatteras, North Carolina. Examination of the species composition of the catch and locations of the fishery throughout the year suggest that the Drift Gillnet Fishery was stratified into two strata: a southern, or winter, stratum and a northern, or summer, stratum. Documented interactions with North Atlantic right whales, humpback whales, sperm whales, pilot whale spp., Mesoplodon spp., Risso's dolphins, common dolphins, striped dolphins and white sided dolphins were reported in this fishery.

Atlantic Tuna Purse Seine

The Tuna Purse Seine Fishery occurring between the Gulf of Maine and Cape Hatteras, North Carolina is directed at large medium and giant Bluefin Tuna (BFT). Spotter aircraft are typically used to locate fish schools. The official start date, set by regulation, is 15 July of each year. Individual Vessel Quotas (IVQs) and a limited access system prevent a derby fishery situation. Catch rates for large medium and giant Tuna can be high and consequently, the season can last only a few weeks, however, over the last number of years, effort expended by this sector of the BFT fishery has diminished dramatically due to the unavailability of BFT on the fishing grounds.

The regulations allocate approximately 18.6% of the U.S. BFT quota to this sector of the fishery (5 IVQs) with a tolerance limit established for large medium BFT (15% by weight of the total amount of giant BFT landed.

Limited observer data is available for the Atlantic Tuna Purse Seine Fishery. Out of 45 total trips made in 1996, 43 trips (95.6%) were observed. Forty-four sets were made on the 43 observed trips and all sets were observed. A total of 136 days were covered. No trips were observed during 1997 through 1999. Two trips (seven hauls) were observed in October 2000 in the Great South Channel Region. Four trips were observed in September 2001. No marine mammals were observed taken during these trips. Documented interactions with pilot whale spp. were reported in this fishery.

Atlantic Tuna Pelagic Pair Trawl

The Pelagic Pair Trawl Fishery operated as an experimental fishery from 1991 to 1995, with an estimated 171 hauls in 1991, 536 in 1992, 586 in 1993, 407 in 1994, and 440 in 1995. This fishery ceased operations in 1996 when NMFS rejected a petition to consider pair trawl gear as an authorized gear type in the Atlantic Tuna Fishery. The fishery operated from August to November in 1991, from June to November in 1992, from June to October in 1993 (Northridge 1996), and from mid-summer to December in 1994 and 1995. Sea sampling began in October of 1992 (Gerrior *et al.* 1994) where 48 sets (9% of the total) were sampled. In 1993, 102 hauls (17% of the total) were sampled. In 1994 and 1995, 52% (212) and 55% (238), respectively, of the sets were observed. Nineteen vessels have operated in this fishery. The fishery operated in the area between 35ºN to 41ºN and 69ºW to 72ºW. Approximately 50% of the total effort was within a one degree square at 39ºN, 72ºW, around Hudson Canyon, from 1991 to 1993. Examination of the 1991-1993 locations and species composition of the bycatch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge 1996). During the 1994 and 1995 Experimental Pelagic Pair Trawl Fishing Seasons, fishing gear experiments were conducted to collect data on environmental parameters, gear behavior, and gear handling practices to evaluate factors affecting catch and bycatch (Goudy 1995, 1996), but the results were inconclusive. Documented interactions with pilot whale spp., Risso's dolphin and common dolphins were reported in this fishery.

Part B. Description of U.S. Gulf of Mexico Fisheries

I. Data Sources

Items 1 and 2 describe sources of marine mammal mortality, serious injury or entanglement data, and item 3

describes the source of commercial fishing effort data used to generate maps depicting the location and amount of fishing effort and the numbers of active permit holders. In general, commercial fisheries in the Gulf of Mexico have had little directed observer coverage and the level of fishing effort for most fisheries that may interact with marine mammals is either not reported or highly uncertain. With the exception of the Large Pelagics Longline Fishery, no incidental take estimates are possible for Gulf of Mexico commercial fisheries.

1. Southeast Region Fishery Observer Programs

Two fishery observer programs are managed by the SEFSC that observe commercial fishery activity in the U.S. Gulf of Mexico. The Pelagic Longline Observer Program (POP) administers a mandatory observer program for the U.S. Atlantic Large Pelagics Longline Fishery. The program has been in place since 1992, and randomly allocates observer effort by eleven geographic fishing areas proportional to total reported effort in each area and quarter. Observer coverage levels are mandated under the Highly Migratory Species FMP (HMS FMP, 50 CFR Part 635). The second is the Southeastern Shrimp Otter Trawl Fishery Observer Program. Prior to 2007, this was a voluntary program administered by SEFSC in cooperation with the Gulf and South Atlantic Fisheries Foundation. The program was funding and project dependent, therefore observer coverage is not necessarily randomly allocated across the fishery. In 2007, the observer program was expanded, and it became mandatory for fishing vessels to take an observer if selected. The program now includes more systematic sampling of the fleet based upon reported landings and effort patterns. The total level of observer coverage for this program is ~ 1% of the total fishery effort. In each Observer Program, the observers record information on the total target species catch, the number and type of interactions with protected species (including both marine mammals and sea turtles), and biological information on species caught. In each Observer Program the observers record information on the total target species catch, the number and type of interactions with protected species including both marine mammals and sea turtles, and biological information on species caught.

2. Regional Marine Mammal Stranding Networks

The Southeast Regional Stranding Network is a component of the Marine Mammal Health and Stranding Response Program (MMHSRP). The goals of the MMHSRP are to facilitate collection and dissemination of data, assess health trends in marine mammals, correlate health with other biological and environmental parameters, and coordinate effective responses to unusual mortality events (Becker *et al.* 1994). The Southeast Region Strandings Program is responsible for data collection and stranding response coordination along the U.S. Gulf of Mexico coast from Florida through Texas. Prior to 1997, stranding and entanglement data were maintained by the New England Aquarium and the National Museum of Natural History, Washington, D.C. Volunteer participants, acting under a letter of agreement with NOAA Fisheries, collect data on stranded animals that include: species; event date and location; details of the event including evidence of human interactions; determinations of the cause of death; animal disposition; morphology; and biological samples. Collected data are reported to the appropriate Regional Stranding Network Coordinator and are maintained in regional and national databases.

3. Southeast Region Fisheries Logbook System

The FLS is maintained at the SEFSC and manages data submitted from mandatory fishing vessel logbook programs under several FMPs. In 1986, a comprehensive logbook program was initiated for the Large Pelagics Longline Fisheries, and this reporting became mandatory in 1992. Logbook reporting has also been initiated since the early 1990s for a number of other fisheries including: Reef Fish Fisheries; Snapper-Grouper Complex Fisheries; federally managed Shark Fisheries; and King and Spanish Mackerel Fisheries. In each case, vessel captains are required to submit information on the fishing location, the amount and type of fishing gear used, the total amount of fishing effort (e.g., gear sets) during a given trip, the total weight and composition of the catch, and the disposition of the catch during each unit of effort (e.g., kept, released alive, released dead). FLS data are used to estimate the total amount of fishing effort in the fishery and thus expand bycatch rate estimates from observer data to estimates of the total incidental take of marine mammal species in a given fishery.

4. Marine Mammal Authorization Program

Commercial fishing vessels engaging in Category I or II fisheries are automatically registered~~required to register~~ under the Marine Mammal Authorization Program (MMAP) in order to lawfully take a non-endangered/threatened marine mammal incidental to fishing operations. These fishermen are required to carry an Authorization Certificate onboard while participating in the listed fishery and must be prepared to carry a fisheries observer if selected. All vessel owners, regardless of the category of fishery they are operating in, are required to

report, within 48 hours of the incident even if an observer has recorded the take, all incidental injuries and mortalities of marine mammals that have occurred as a result of fishing operations (NMFS-OPR 2003). Events are reported by fishermen on the Marine Mammal Mortality/Injury forms then submitted to and maintained by the NMFS Office of Protected Resources. The data reported include: captain and vessel demographics; gear type and target species; date, time and location of event; type of interaction; animal species; mortality or injury code; and number of interactions. Reporting forms are available online at http://www.nmfs.noaa.gov/pr/pdfs/interactions/mmap_reporting_form.pdf.

II. Gulf of Mexico Commercial Fisheries

~~Atlantic Ocean, Caribbean, Gulf of Mexico Large Pelagics Longline~~

~~Target Species: Large pelagic fish species including: Swordfish, Yellowfin Tuna, Bigeye Tuna, Bluefin Tuna, Albacore Tuna, Dolphin Fish, Shortfin Mako Shark, and a variety of other shark species.~~

~~Number of Permit Holders: < 100~~

~~Number of Active Permit Holders: The number of active fishing vessels in the pelagic longline fishery has been declining since a peak number of 361 vessels reporting longline effort during 1995. Over the period between 1995 and 2000, the mean number of vessels reporting effort to the FLS in the Gulf of Mexico was 112. This declined to an annual average of 64 for the period between 2001 and 2007. The total number of fishing vessels reporting effort in the Gulf of Mexico during 2008 was 53, though some of these vessels likely also reported fishing effort in other areas.~~

~~Total Effort: The total fishing effort in the Gulf of Mexico component of the Pelagic Longline Fishery has ranged between 2.5 and 4.1 million hooks since 1992. The mean effort reported to the FLS between 1995 and 2000 was 4,545 sets and 3.32 million hooks. Between 2001 and 2007, a mean of 4,522 sets (3.40 million hooks) was reported each year. During 2008, the total reported fishing effort in the Gulf of Mexico component of the fishery was 3,246 sets and 2.39 million hooks (Garrison *et al.* 2009).~~
~~Temporal and Spatial Distribution: Fishing effort occurs year-round and operates in waters both inside and outside the U.S. EEZ throughout Atlantic, Caribbean and Gulf of Mexico waters. The Gulf of Mexico component of the fleet operates both in continental shelf and deep continental slope waters from Florida to Texas.~~

~~Gear Characteristics: The pelagic longline gear consists of a mainline of >700 lb test monofilament typically ranging between 10 and 45 miles long. At regular intervals along the mainline, bullet-shaped floats are suspended and long sections of the gear are marked by "high flyers" or radio beacons. Suspended from the mainline are long gangion lines of 200 to 400 lb test monofilament that are typically 100 to 200 feet in length. Fishing depths are most typically between 40 and 120 feet. Hooks of various sizes are attached by a steel swivel leader. Longline sets targeting tunas are typically set at dawn and soak throughout the day with recovery near dusk. Those sets targeting swordfish are more typically night sets. The total amount of time the gear remains in the water including set, soak, and haul times is typically 10-14 hours. As a result of a recent Biological Opinion on interactions between Atlantic longline gear targeting Tunas and Swordfish and endangered sea turtles, a comprehensive change in the fishing gear occurred in the longline fishery. After August 2004, only circle shaped hooks of 16/0 or 18/0 size can be used throughout the fishery.~~

~~Management and Regulations: The Large Pelagics Longline Fishery is listed as a Category I fishery under the MMPA's 20122009 LOF due to frequently observed interactions with marine mammals ((76 FR 73912;November 29, 2011).(73 FR 73066, December 1, 2008). The directed fishery is managed under the FMP for Atlantic Tunas, Swordfish, and Sharks (Highly Migratory Species FMP, 50 CFR Part 635) and the Pelagic Longline Take Reduction Plan implementing regulations (74 FR 23349, May 19, 2009). The fishery has also been the focus of management actions relating to bycatch of billfish. Amendment One to the Atlantic Billfish FMP also pertains to the Large Pelagics Longline Fishery and is consistent with the regulations in the Highly Migratory Species FMP. This fishery is also regulated under the Endangered Species Act resulting from frequent interactions with endangered sea turtle species including both Loggerhead and Leatherback Turtles in the Atlantic and Gulf of Mexico. A Biological Opinion issued by the NMFS Southeast Regional Office in June 2004 mandated the use of circle hooks throughout the fishery, mandated the use of de-hooking and disentanglement gear by fishermen to reduce the mortality of captured sea turtles, and mandated increased reporting and monitoring of the fishery.~~

~~Observer Coverage: The Pelagic Longline Observer Program (POP) is a mandatory observer program managed by the SEFSC that has been in place since 1992. Observers are placed upon randomly selected vessels with total observer effort allocated on a geographic basis proportional to the total amount of fishing effort reported by the fleet. The target observer coverage level was 5% of reported sets through 2001, and was elevated to 8% of total sets in 2002. Between 2000 and 2007, percent observer coverage of reported sets in the Gulf of Mexico component of the fishery was 4, 4, 3, 5, 5, 7, 8, and 16. Observer coverage in the Gulf of Mexico during 2008 was 24.8% of reported sets. This high coverage rate reflects significantly elevated coverage during the second quarter (58.2%) associated with increased observer effort to document bluefin tuna interactions (Garrison *et al.* 2009). Observed longline sets and marine mammal interactions in the Gulf of Mexico are shown for 2004-2008 in Figures 46 through 50.~~

~~Comments: This fishery has been the subject of numerous management actions over the last four years associated with bycatch of both billfish and sea turtles. These changes have resulted in a reduction of overall fishery effort and in the behaviors of the fishery. The most significant change was the closure of the Northeast Distant Water Area off the Canadian Grand Banks and near the Azores as of June 1, 2001 (50 CFR Part 635). In the Gulf of Mexico, a year round closure was implemented in two areas in DeSoto Canyon (NMFS 2003). Additionally, a ban on the use of live fish bait was initiated in 1999 due to concerns over billfish bycatch. The June 2004 Biological Opinion has resulted in a significant change in the gear and fishing practices of this fishery that will likely impact marine mammal bycatch. The majority of interactions with marine mammals in this fishery in the Gulf of Mexico have been with Risso's Dolphin (Garrison 2003a). There have been more interactions with marine mammals observed recently in association with the very high observer coverage between April and June.~~

~~Protected Species Interactions: Gulf of Mexico stocks of Risso's dolphin, pantropical spotted dolphin, Atlantic spotted dolphin, pilot whales, dwarf or pygmy sperm whales, unidentified beaked whales, sperm whales, killer whales, and offshore bottlenose dolphin.~~

~~Protected Species Interactions: Gulf of Mexico stocks of coastal and continental shelf bottlenose dolphin and Atlantic spotted dolphin.~~

Spiny Lobster Trap/Pot Fishery

Current category: Category III

~~Basis for current classification on the LOF: Based on analogy to the Category II "Atlantic blue crab trap/pot" fishery, and serious injury and mortality to bottlenose dolphins (multiple stocks) reported in stranding data.~~

Current list of marine mammal species/stocks injured/killed: Potentially Bottlenose dolphin, Biscayne Bay estuarine; ~~Bottlenose dolphin, Central Florida (FL) coastal; Bottlenose dolphin, Eastern Gulf of Mexico (GMX) coastal;~~ and Bottlenose dolphin, FL Bay~~; Bottlenose dolphin, GMX bay, sound, estuarine (FL west coast portion); Bottlenose dolphin, Indian River Lagoon estuarine system; Bottlenose dolphin, Jacksonville estuarine system; Bottlenose dolphin, Northern GMX coastal.~~.

Gear ~~Characteristics~~Description: Spiny lobster trap/pot gear most commonly used in the commercial fishery is a cube made of wooden slats. Wire traps are occasionally used, but more frequently in deeper water. Concrete is typically poured in the bottom of traps to weight them. A buoy is attached to the trap via a float line and floated at the surface. -Buoys attached to spiny lobster traps must be marked with the letter "C." Tags displaying the crawfish endorsement number are also required on all traps.

The type of bait used in traps depends on fisher preference. Some traps are set unbaited, some are baited with fish scraps, sardines, cat food or cowhide, while others are baited with legal sized or undersized lobsters used to attract larger lobsters. Soak times average from 8 to 28 days, with soak times increasing as the season progresses and catch rates decline (Matthews 2001).

~~Larger vessels in the Lower Florida Keys may set traps several miles apart and usually allow traps to soak for up to two weeks (Powers and Bannerot 1984). Vessels of this size are also capable of fishing 500 traps a day (GMFMC and SAFMC 1982). The smaller vessels of the Upper Florida Keys also stay closer to shore and the duration of their~~

~~trips is shorter than the larger vessels operating out of the Lower Keys (GMFMC and SAFMC 1987).~~
~~**Gear description/method for fishing: Traps are the most typical gear type used for the commercial and recreational stone crab fishery. Baited traps are frequently set in waters of 65 ft (19.8 m) depth or less in a double line formation, generally 100-300 ft (30.5-91.4 m) apart, running parallel to a bottom contour. Buoys are attached to the trap/pot via float line.**~~

Target Species: Caribbean spiny lobster (*Panulirus argus*), smooth tail spiny lobster (*Panulirus lauvicauda*) and spotted spiny lobster (*Panulirus guttatus*).
~~Target Species: Florida stone crab (*Menippe mercenaria*)~~

Temporal and Spatial Distribution: The distribution of the commercial and recreational spiny lobster harvest off Florida is almost exclusively limited to the waters of the Florida Keys (GMFMC and SAFMC 1982). Effort occurs on both the Atlantic and Gulf side of the Florida Keys; however, diving for lobster is most common on the Gulf side (NMFS 2009). Fishing occurs from very nearshore areas out to water depths of 200 ft, although most fishing occurs in waters less than 100 ft.

The commercial and regular recreational spiny lobster seasons (in both state and federal waters of Florida and other Gulf states) start on August 6 and end on March 31 (F.A.C. Chapter 68B-24.005(1) Florida Statutes; 50 CFR 640.20(b)) with the exception of the two-day sport season in which trap gear is prohibited.
~~Spatial/temporal distribution of effort: Operates primarily nearshore in the State of Florida. Stone crab fishing outside of this area is likely very minimal. The margins of seagrass flats and bottoms with low rocky relief are also favored areas for trap placement. The season for commercial and recreational stone crab harvest is from October 15 to May 15.~~
~~Management and regulations: The stone crab trap/pot fishery is currently a Category II fishery under the MMPA's 2012 List of Fishery (76 FR 73912;November 29, 2011) due to occasional interactions with marine mammals (50 CFR 229). In FL, commercial trap/pot buoys are required to be marked with the letter "X," the trap owner's stone crab endorsement number (in characters at least 2 inches high), and a tag that corresponds to a valid FWC issued trap certificate. Recreational trap/pot buoys, except those fished from a dock, must have a permanently affixed and legible "R" at least 2 inches high and the harvester's name and address (Ch. 68B-13.009(3), F.A.C).~~

Management and Regulations: The spiny lobster trap/pot fishery is currently a Category III fishery under the MMPA's 2012 List of Fishery (76 FR 73912;November 29, 2011) due to a remote likelihood of serious injuries or mortalities to marine mammals (50 CFR 229). Since the majority of this fishery occurs off South Florida, the management involves both State and Federal jurisdictions.

The fishery is currently managed via bag limits, minimum size limits, regulated fishing seasons for the commercial and recreational sectors, gear restrictions, trap construction requirements and a trap limitation and permitting program.

Total Effort: Over the last 10 years, commercial trap fishing has been the dominant gear type in the spiny lobster fishery, accounting for approximately 70 percent of all commercial landings (Robson 2006). The remaining landings are collected via divers by hand or via bully nets (which accounts for only a very small percentage). A trap limitation program initiated by the State of Florida in 1993 has reduced the number of lobster traps available annually from approximately one million to 485,891 trap tag certificates for the 2010 season (A. Podey, Florida Fish and Wildlife Conservation Commission (FFWCC) to A. Herndon, NMFS, pers. comm., 2010).

~~Commercial landings of spiny lobster in the contiguous United States have been reported in Florida, Alabama, Georgia, Mississippi, South Carolina and Texas since 1962. However, in 35 of the 45 years from 1962 through 2006, Florida landings, mostly from the Florida Keys, accounted for all of the annual commercial landings; and in each of the other 10 years, annual landings in Florida represented at least 94% of the total pounds commercially landed that year. In 2006, 100% of all 4,773,995 pounds of spiny lobster landings were within the State of Florida. Also 80% of fishing effort for this fishery is within state of Florida waters.~~

~~Trap fishing is the most common gear type used in the Florida Keys. Vessels operating in the lower Florida Keys typically fish up to 2,000 traps, but a few fishers may use as many as 5,000 traps (D. Gregory, Florida Sea Grant, to~~

~~A. Herndon, NMFS, pers. comm., 2006). Vessels fishing off the upper Florida Keys are generally smaller day crafts that carry no more than 500-800 traps. Unlike the larger vessels fishing in the Lower Keys, these fishers tend to pull 100-300 traps per day.~~

~~Recreational fishing for spiny lobsters is primarily conducted by divers using scuba equipment, hookah rigs or free-diving to collect lobsters by hand (GMFMC and SAFMC 1987). Recreational fishers without a SRCL are not allowed to use traps to capture lobster.~~
~~Total Effort: Due to the Stone Crab Trap Reduction Schedule [F.A.C. Chapter 68B-13.010(3)(f) Florida Statutes], the number of commercial trap certificates issued by the State of Florida has decreased from approximately 1,475,000 in the 2002-2003 fishing season to 1,190,285 in the 2010 fishing season. The Stone Crab Trap Reduction Schedule [F.A.C. Chapter 68B-13.010(3)(f) Florida Statutes] will eventually reduce the number of trap tags to 600,000 trap/pots statewide. Pots will be reduced by a pre-specified percentage each year until the number of trap tags reaches 600,000 (Muller *et al.* 2006).~~

~~Florida state regulations limit recreational stone crab trap/pot numbers to five per person [F.A.C. Chapter 68B-13] Florida Statutes]. Because no documentation or registration is required for recreational stone crab fishing, no accurate estimate of the magnitude of this fishery is possible (Bert *et al.* 1978).~~

Observer Coverage: There is no observer coverage in this fishery.

Comments: Based on the similar gear type used in a number of different trap/pot fisheries (e.g., blue crab, stone crab, etc.) especially in coastal Florida waters, bottlenose dolphin strandings associated with this fishery are likely underestimated. Derelict trap/pot gear is also a substantial concern for marine life entanglements. It is estimated that between 10-20% of all traps (i.e., 50,000-100,000) are lost annually.
~~Comments: Based on the similar gear type used in a number of different pot fisheries (e.g., blue crab, spiny lobster, etc.) especially in coastal Florida waters, bottlenose dolphin strandings associated with this fishery are likely underestimated. Derelict trap/pot gear is also a substantial concern for marine life entanglements.~~

~~Target Species: Caribbean spiny lobster (*Panulirus argus*), smooth tail spiny lobster (*Panulirus lauvicauda*) and spotted spiny lobster (*Panulirus guttatus*). These species are commonly referred to as crawfish.~~

~~Number of Permit Holders: As of May 19, 2009, there were 1,268 State of Florida issued spiny lobster permits (A. Herndon, NMFS, pers. comm., 2010). There are no federal permits for this fishery since the State of Florida issues permits that are also valid in federal waters.~~

~~Number of Active Permit Holders: The number of spiny lobster endorsements or licenses (also known as trap numbers) required for any person using traps to harvest spiny lobster in commercial quantities (F.A.C. Chapter 68B-24.0055(1) Florida Statutes) in state waters has declined from nearly 2,500 licenses in the 1998-1999 season to 1,241 licenses for the 2007-2008 season. In state waters, recreational fishers wishing to use traps to harvest spiny lobster are required to have a Special Recreational Crawfish License (SRCL). The number of SRCL holders has also decreased from over 350 licenses in the 1998-1999 season to approximately 200 in the 2007-2008 season.~~

~~Total Effort: Over the last 10 years, commercial trap fishing has been the dominant gear type in the spiny lobster fishery, accounting for approximately 70 percent of all commercial landings (Robson 2006). The remaining landings are collected via divers by hand or via bully nets (which accounts for only a very small percentage). A trap limitation program initiated by the State of Florida in 1993 has reduced the number of lobster traps available annually from approximately one million to 485,891 trap tag certificates for the 2010 season (A. Podey, Florida Fish and Wildlife Conservation Commission (FFWCC) to A. Herndon, NMFS, pers. comm., 2010).~~

~~Commercial landings of spiny lobster in the contiguous United States have been reported in Florida, Alabama, Georgia, Mississippi, South Carolina and Texas since 1962. However, in 35 of the 45 years from 1962 through~~

~~2006, Florida landings, mostly from the Florida Keys, accounted for all of the annual commercial landings; and in each of the other 10 years, annual landings in Florida represented at least 94% of the total pounds commercially landed that year. In 2006, 100% of all 4,773,995 pounds of spiny lobster landings were within the State of Florida. Also 80% of fishing effort for this fishery is within state of Florida waters.~~

~~Trap fishing is the most common gear type used in the Florida Keys. Vessels operating in the lower Florida Keys typically fish up to 2,000 traps, but a few fishers may use as many as 5,000 traps (D. Gregory, Florida Sea Grant, to A. Herndon, NMFS, pers. comm., 2006). Vessels fishing off the upper Florida Keys are generally smaller day crafts that carry no more than 500-800 traps. Unlike the larger vessels fishing in the Lower Keys, these fishers tend to pull 100-300 traps per day.~~

~~Recreational fishing for spiny lobsters is primarily conducted by divers using scuba equipment, hookah rigs or free-diving to collect lobsters by hand (GMFMC and SAFMC 1987). Recreational fishers without a SRCL are not allowed to use traps to capture lobster.~~

~~Temporal and Spatial Distribution: The distribution of the commercial and recreational spiny lobster harvest off Florida is almost exclusively limited to the waters of the Florida Keys (GMFMC and SAFMC 1982). Effort occurs on both the Atlantic and Gulf side of the Florida Keys; however, diving for lobster is most common on the Gulf side (NMFS 2009). Fishing occurs from very nearshore areas out to water depths of 200 ft, although most fishing occurs in waters less than 100 ft.~~

~~The commercial and regular recreational spiny lobster seasons (in both state and federal waters of Florida and other Gulf states) start on August 6 and end on March 31 (F.A.C. Chapter 68B-24.005(1) Florida Statutes; 50 CFR 640.20(b)) with the exception of the two-day sport season in which trap gear is prohibited.~~

~~Gear Characteristics: Spiny lobster trap/pot gear most commonly used in the commercial fishery is a cube made of wooden slats. Wire traps are occasionally used, but more frequently in deeper water. Concrete is typically poured in the bottom of traps to weight them. A buoy is attached to the trap via a float line and floated at the surface. Buoys attached to spiny lobster traps must be marked with the letter "C." Tags displaying the crawfish endorsement number are also required on all traps.~~

~~The type of bait used in traps depends on fisher preference. Some traps are set unbaited, some are baited with fish scraps, sardines, cat food or cowhide, while others are baited with legal sized or undersized lobsters used to attract larger lobsters. Soak times average from 8 to 28 days, with soak times increasing as the season progresses and catch rates decline (Matthews 2001).~~

~~Larger vessels in the Lower Florida Keys may set traps several miles apart and usually allow traps to soak for up to two weeks (Powers and Bannerot 1984). Vessels of this size are also capable of fishing 500 traps a day (GMFMC and SAFMC 1982). The smaller vessels of the Upper Florida Keys also stay closer to shore and the duration of their trips is shorter than the larger vessels operating out of the Lower Keys (GMFMC and SAFMC 1987).~~

~~Management and Regulations: The spiny lobster trap/pot fishery is currently a Category III fishery under the MMPA's 2012 List of Fishery (76 FR 73912;November 29, 2011)MMPA due to a remote likelihood of serious injuries or mortalities to marine mammals (50 CFR 229). Bottlenose dolphin stocks with documented and confirmed interactions with the spiny lobster fishery include the Biscayne Bay and Florida Bay sStocks. However, based on the overlap between this fishery and stranding data, other bottlenose stocks such as the Northern Florida Coastal Stock, Central Florida Coastal Stock and the Indian River Lagoon Estuarine System Stock are also potentially impacted by this fishery.~~

~~There is not fishery management planSince spiny lobster fishing effort occurs nearly exclusively in both Florida state and surrounding federal waters, the Fishery Management Plan for Spiny Lobster, but rather, the federal and state fishery is (SLFMP), jointly managed by the South Atlantic and Gulf of Mexico Fishery Management Councils, basically extends the Florida Fish and Wildlife Commission rules regulating the state fishery to the southeastern U.S. EEZ in order to streamline state and federal management.~~

~~The fishery is currently managed via bag limits, minimum size limits, regulated fishing seasons for the commercial~~

~~and recreational sectors, gear restrictions, trap construction requirements and a trap limitation and permitting program.~~

~~Observer Coverage: There is no observer coverage in this fishery.~~

~~Comments: Based on the similar gear type used in a number of different trap/pot fisheries (e.g., blue crab, stone crab, etc.) especially in coastal Florida waters, bottlenose dolphin strandings associated with this fishery are likely underestimated. Derelict trap/pot gear is also a substantial concern for marine life entanglements. It is estimated that between 10-20% of all traps (i.e., 50,000-100,000) are lost annually.~~

~~Protected Species Interactions: Based on bottlenose dolphin stranding data from the United States' Atlantic coast between 2002-April 2009, there have been two bottlenose dolphin strandings likely to have resulted from the lobster pot fishery. Gear determination was based on local knowledge and gear analyses techniques. These animals were most likely associated with the Biscayne Bay or Central Florida Coastal Stocks. An additional eight bottlenose dolphin strandings in Florida had trap/pot gear on the carcass, but the gear could not be definitively identified to a target species or specific fishery. Therefore, based on known interactions with trap/pot gear and bottlenose dolphin stocks in times and areas where the spiny lobster trap/pot fishery is known to occur, the following bottlenose dolphin stocks may also be affected by this fishery: Northern Florida Coastal Stock, Indian River Lagoon Estuarine System Stock, Florida Bay Stock and Biscayne Bay s~~Stock.

~~GMFMC and SAFMC. 1982. Fishery Management Plan, Environmental Impact Statement, and Regulatory Impact Review for Spiny Lobster in the Gulf of Mexico and South Atlantic. March. Gulf of Mexico Fishery Management Council, Lincoln Center, Suite 331, 5401 West Kennedy Boulevard, Tampa, Florida 33609. South Atlantic Council, Southpark Building, Suite 306, 1 Southpark Circle, Charleston, South Carolina 29407-4699.~~

~~GMFMC and SAFMC. 1987. Amendment Number 1 to Spiny Lobster Fishery Management Plan for the Gulf of Mexico and South Atlantic. Including Environmental Assessment, Supplemental Regulatory Impact Review, and Initial Regulatory Flexibility Analysis. February. Gulf of Mexico Fishery Management Council, Lincoln Center, Suite 331, 5401 West Kennedy Boulevard, Tampa, Florida 33609. South Atlantic Council, Southpark Building, Suite 306, 1 Southpark Circle, Charleston, South Carolina 29407-4699.~~

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~~S~~Southeastern U.S. Atlantic, Gulf of Mexico Stone Crab Trap/Pot Fishery

Current category: Category II

Basis for current classification on the LOF: Based on analogy to the Category II "Atlantic blue crab trap/pot" fishery, and serious injury and mortality to bottlenose dolphins (multiple stocks) reported in stranding data.

Current list of marine mammal species/stocks injured/killed: Bottlenose dolphin, Biscayne Bay estuarine; Bottlenose dolphin, Central Florida (FL) coastal; Bottlenose dolphin, Eastern Gulf of Mexico (GMX) coastal; Bottlenose dolphin, FL Bay; Bottlenose dolphin, GMX bay, sound, estuarine (FL west coast portion); Bottlenose dolphin, Indian River Lagoon estuarine system; Bottlenose dolphin, Jacksonville estuarine system; Bottlenose dolphin, Northern GMX coastal.

Gear description/method for fishing: Traps are the most typical gear type used for the commercial and recreational stone crab fishery. -Baited traps are frequently set in waters of 65 ft (19.8 m) depth or less in a double line formation, generally 100-300 ft (30.5-91.4 m) apart, running parallel to a bottom contour. -Buoys are attached to the trap/pot via float line.

Target Species: Florida stone crab (*Menippe mercenaria*)

~~Number of Permit Holders: In 2010, the State of Florida issued 1,282 stone crab licenses and 1,190,285 stone crab trap tags. Currently, there are no federal reporting requirements for the federal stone crab fishery. All data regarding the fishery have been collected via partnership with the State of Florida, through its trip ticket program.~~
Spatial/temporal distribution of effort: -Operates primarily nearshore in the State of Florida. -Stone crab fishing outside of this area is likely very minimal. -The margins of seagrass flats and bottoms with low rocky relief are also favored areas for trap placement. The season for commercial and recreational stone crab harvest is from October 15 to May 15.

Management and regulations: The stone crab trap/pot fishery is currently a Category II fishery under the MMPA's 2012 List of Fishery (76 FR 73912;November 29, 2011) due to occasional interactions with marine mammals (50 CFR 229). –In FL, commercial trap/pot buoys are required to be marked with the letter "X," the trap owner's stone crab endorsement number (in characters at least 2 inches high), and a tag that corresponds to a valid FWC-issued trap certificate. ~~-Recreational trap/pot buoys, except those fished from a dock, must have a permanently affixed and legible "R" at least 2 inches high and the harvester's name and address (Ch. 68B-13.009(3), F.A.C).~~ -There is not fishery management plan for Spiny Lobster, but rather, the federal and state fishery is managed by the Florida Fish and Wildlife Commission in order to streamline state and federal management.

Total Effort: Due to the Stone Crab Trap Reduction Schedule [F.A.C Chapter 68B-13.010(3)(f) Florida Statutes], the number of commercial trap certificates issued by the State of Florida has decreased from approximately 1,475,000 in the 2002-2003 fishing season to 1,1~~9~~190,~~285~~449 in the ~~2010~~ 2011-2012 fishing season. The Stone Crab Trap Reduction Schedule [F.A.C Chapter 68B-13.010(3)(f) Florida Statutes] will eventually reduce the number of trap tags to 600,000 trap/pots statewide. Pots will be reduced by a pre-specified percentage each year until the number of trap tags reaches 600,000 (Muller *et al.* 2006).

~~Florida state regulations limit recreational stone crab trap/pot numbers to five per person [F.A.C. Chapter 68B-13] Florida Statutes]. Because no documentation or registration is required for recreational stone crab fishing, no accurate estimate of the magnitude of this fishery is possible (Bert *et al.* 1978).~~

~~Temporal and Spatial Distribution: The season for commercial and recreational stone crab harvest is from October 15 to May 15.~~

~~This commercial fishery operates primarily nearshore in the State of Florida (stone crab fishing outside of this area is likely very minimal). The stone crab trap/pot fishery occurs on both sides of Florida Keys (Gulf of Mexico and Atlantic), but is much more extensive along the Gulf of Mexico side. Crabbers place their traps in waters of 65 foot depth or less and intense trapping extends from the boundary of Everglades National Park through the Gulf of Mexico side of the Marquesa Keys (T. Bert, Florida Fish and Wildlife Conservation Commission (FFWCC), to A. Herndon, NMFS, pers. comm. 2006). Crabbers off Marathon, Florida, typically set traps deeper than the smaller operations of the Upper and Lower Keys, and often work thousands of traps per season (Bert *et al.* 1978).~~

~~Distribution of the stone crab trap/pot fishery varies throughout the Gulf of Mexico side of Florida. The stone crab fishery off Collier County is centered in Chokoloskee. It generally extends from the Shark River Basin to Cape Romano and seaward to approximately a 65 foot depth. Crabbers generally work from 1,000 to 3,000 traps per season; a few crabbers fish as many as 8,000 traps per season (Bert *et al.* 1978; T. Bert, FFWCC, to A. Herndon, NMFS, pers. comm. 2008). In Lee and Charlotte counties of Florida, the crabbers often fish fewer than 200 trap/pots per season in waters less than 20 feet deep. Within Tampa and Sarasota Bay, crabbers fish between a few hundred to a few thousand traps per season. Crabbers in Tarpon Springs and Homasassa fish thousands of traps seasonally and the fishery offshore from this area appears to be the most heavily fished of any area in the state (T. Bert, FFWCC,~~

unpublished data). Within the Taylor, Dixie, Levy, and Citrus counties of Florida, crabbers may use up to 1,000 traps per season. There are few commercial stone crabbers in the Florida panhandle region.

Gear Characteristics: Traps are the exclusive gear type used for the commercial stone crab fishery. Stone crab traps are constructed of pressure-treated pine or cypress slats or of plastic (Bert *et al.* 1978). The tops of the traps have a hinged lid that is opened to gain access to the catch. A 4-inch by 6-inch plastic opening in the center of the lid serves as the mouth of the trap, which allows crabs to enter. Fishers pour concrete into the bottom of these traps to weight them.

All traps must be designed to conform to the specifications established under 50 CFR 654.22, as well as State of Florida statutes. A marking buoy and line are attached to each commercial trap (GMFMC 1979) which is denoted with the letter "X." No trap is allowed to be larger than 24 by 24 by 24 inches and several requirements also exist for escape vents, throat, sizes and configuration (50 CFR 654.22).

Traps are baited with bait fish or fish remnants. Mullet, grouper or snapper heads and skeletons, jacks, sharks and skates or rays are commonly used baits (GMFMC 1979). Pigs' feet and cowhide have also become common baits in recent years. One to three pounds of bait is generally used per trap. Bait configuration within the trap depends on fisher preference. Some fishers simply place the bait on the bottom of the trap; some place it in a bait container, and others suspend the bait from the top of the trap. Baits may last anywhere from two days to several weeks, depending upon their type, amount and placement inside the trap (Bert *et al.* 1978).

Baited traps are frequently set in a double line formation, generally 100-300 ft apart, running parallel to a bottom contour. Some fishers prefer to lay traps in a grid, crisscross or circular pattern. Traps are usually set on sandy or grassy bottom with scattered sponges, rocks, soft corals or small coral heads (Bert *et al.* 1978). The margins of seagrass flats and bottoms with low rocky relief are also favored areas for trap placement (T. Bert, FFWCC, to A. Herndon, NMFS, pers. comm., 2006).

Fishers who operate large vessels usually allow their traps to soak for 10 to 21 days. After the trap has been retrieved, the catch is removed, the trap is re-baited, minor repairs are made to the trap if necessary, and then the trap is reset. Stone crab fishing is conducted almost entirely during one-day trips (GMFMC 1979).

Depending on the experience of the crew, a three-man crew may haul and reset anywhere from 25 to 100 traps per hour. This rate is also highly dependent on tide, weather conditions, smoothness of operation and the condition of equipment. Sixty traps an hour is considered an average rate for larger vessels (Bert *et al.* 1978). Per season, stone crab fishers operating large vessels may set from 1,500 to 8,000 traps or more; a few leaders in the fishery may own several vessels ranging 60-85 ft in length and fish up to 10,000 traps per season (T. Bert, FFWCC, to A. Herndon, pers. comm., 2006).

Small vessels (30 ft or less) generally fish shallower waters and pull their traps every few days. They use the same techniques described above to set and retrieve their traps, but powered haulback devices are rarely employed. The number of traps worked per day by these single-man crews, ranges from less than 25 to 300. Over a season, the number of traps set by these smaller operators varies but may be as high as 1,500 (Bert *et al.* 1978).

The recreational stone crab trap/pot fishery is composed of crabbers that use much of the same equipment and techniques as the commercial crabbers described above. Most recreational trap fishers fish only a few traps (Florida state regulations limit recreational stone crab trap number to 5 per person [F.A.C. Chapter 68B-13, Florida Statutes]) and set them in shallow water (20 ft or less). The State of Florida has no specific marking requirement for recreational crab trap/pots.

Management and Regulations: The stone crab trap/pot fishery is currently a Category II fishery under the MMPA's 2012 List of Fishery (76 FR 73912;November 29, 2011) due to occasional interactions with marine mammals (50 CFR 229).III fishery under the MMPA due to a remote likelihood of serious injuries or mortalities to marine mammals (50 CFR 229). Based on stranding data and confirmation of gear to the stone crab fishery, the bottlenose dolphin Sstocks with known interactions most significantly impacted by with this fishery include the Biscayne Bay estuarine bottlenose dolphin sStock. However, based on stranding data, other bottlenose stocks such as the Lemon Bay Stock; the Pine Sound, Charlotte Harbor, Gasparilla Sound Stock, and Eastern Coastal Stock (Gulf of Mexico).

~~Other bottlenose dolphin stocks with stranding data documenting interactions with trap pot gear for which the gear may be stone crab include; the Caloosahatchee River Stock,; the Florida Bay Stock; the Central Florida Coastal Stock (Atlantic Ocean), and Jacksonville Estuarine System sStock,. Based on the stone crab fishery effort, all bay, sound, and estuary stocks in Florida ; and the Jacksonville Estuarine System Stock are potentially impacted by this fishery.~~

~~The State of Florida and the Gulf of Mexico Fishery Management Council (GMFMC) manage this fishery jointly (GMFMC 2001). The GMFMC and NMFS both acknowledge the fishery is primarily a state fishery, and requires cooperative state/federal management. Federal management of the stone crab fishery consists primarily of the concurrent regulations established to support existing State of Florida regulations.~~

~~Under the FMP, the federal management area for the stone crab trap/pot fishery is defined as the EEZ off the coast of Florida from a line extending directly south from the Alabama/Florida boundary (87°31'06" W. long.) to a line extending directly east from the Dade/Monroe County, Florida, boundary (25º20.4' N. lat.) (as a federal management area, this does not include state waters within three miles of shore although the regulations are concurrent with state waters). The stone crab management area overlaps jurisdictions of the GMFMC and the South Atlantic Fishery Management Council (SAFMC). Due to this overlap, the GMFMC acts as the lead federal agency for developing, amending, and managing the stone crab fishery and its FMP while working concurrently with the State of Florida, though any federal management decisions are submitted to the SAFMC for review as well.~~

~~The fishery is currently managed through seasonal closures, effort limitations, harvest limitations, permit requirements, trap construction requirements, and a passive trap limitation program managed by the State of Florida. Recreational fishers must follow the same guidelines as commercial fishers unless otherwise noted.~~

Observer Coverage: There is no observer coverage in this fishery.

Comments: Based on the similar gear type used in a number of different pot fisheries (e.g., blue crab, spiny lobster, etc.) especially in coastal Florida waters, bottlenose dolphin strandings associated with this fishery are likely underestimated. Derelict trap/pot gear is also a substantial concern for marine life entanglements.

~~Protected Species Interactions: Based on Florida Atlantic stranding data from 2002-April 2009 and Florida Gulf of Mexico Stranding Data from 2002-2009~~2010, there have been two~~5 bottlenose dolphin strandings that have resulted from the stone crab trap/pot fishery and six~~8 bottlenose dolphin strandings that are a result of pot fisheries that could not be definitively identified to a specific fishery. ~~Based on stranding data and confirmation of gear to the stone crab fishery, the bottlenose dolphin stocks with known interactions with this fishery include the Biscayne Bay Stock and Eastern Coastal Stock (Gulf of Mexico). Other stocks with stranding data documenting interactions with trap pot gear for which the gear may be stone crab include the Caloosahatchee River Stock, Central Florida Coastal Stock (Atlantic Ocean), and Jacksonville Estuarine System Stock. Documented potential interactions with the Stone Crab Trap/Pot Fishery possibly affect the following bottlenose dolphin stocks: Lemon Bay; Pine Sound, Charlotte Harbor, Gasparilla Sound; Caloosahatchee River; Florida Bay; Central Florida Coastal, and the Jacksonville Estuarine System.~~

~~Bert, T.M., RE., Warner, and L.D. Kessler. 1978. The biology and Florida fishery of the Stone Crab *Menippe mercenaria* (Say), with emphasis on southwest Florida. Florida Sea Grant, Technical Paper, No.9, 82 pp. October.~~

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~~Gulf of Mexico Blue Crab Trap/Pot Fisheries~~

~~The Blue Crab Trap/Pot Fishery is broadly distributed in estuarine and nearshore coastal waters along the Gulf coast. The fishery is estimated to have approximately 4,000 participants deploying gear on a year-round basis. Pots are baited with fish or poultry and are typically set in rows in shallow water. Pot position is marked by either a floating or sinking buoy line attached to a surface buoy. In recent years, reports of strandings in the Atlantic with evidence of interactions between bottlenose dolphins and both recreational and commercial crab pot fisheries have been increasing in the Southeast region (McFee and Brooks 1998). Interactions have also been reported in the Gulf, including both stranding mortalities and entanglements/live releases. Interactions with crab pots appear to generally involve a dolphin becoming wrapped in the buoy line. The total number of these interactions and associated mortality rates has not been documented. ; although, Southeast Fishery Science Center stranding data document one bottlenose dolphin interaction in 2002 and one in 2003.However, based on Gulf of Mexico Stranding Data from 2002-2010, there has been 1 mortality and 2 bottlenose dolphin disentanglements with live releases that have likely resulted from the blue crab trap/pot fishery, and 1 mortality and 24 bottlenose dolphin disentanglements with live releases that were a result of pot fisheries that may have been blue crab but could not be definitively identified to a specific fishery. The fishery has been defined as a Category IIIII fishery in the 20122011 List of Fisheries (76 FR 73912;November 29, 2011).(75 FR 68468, November 8, 2009).~~

Gulf of Mexico Menhaden Purse Seine Fishery

Current category: Category II

Basis for current classification on the LOF: Based on a review of observer data from 1992-1995. ~~-~~Observers recorded 9 incidental takes, 8 (3 mortalities) from the Western Gulf of Mexico [GMX] coastal bottlenose stock and 1 from the Northern GMX coastal stock. ~~-~~All of the lethal takes occurred in an area encompassing the Western GMX coastal stock of bottlenose dolphins. Extrapolating the takes from the average observer effort indicated the annual average mortality and serious injury was 68 animals/year, exceeding 100% of the Potential Biological Removal (PBR) level for the Western coastal stock (PBR=29), qualifying this fishery as a Category I fishery on the LOF. However, NMFS categorized this fishery as a Category II pending a revised analysis of stock structure for bottlenose dolphin in the GMX. If all bottlenose stocks in the GMX were grouped together PBR would equal 154, putting the fishery in Category II (68 animals/year is 44% of PBR when PBR is 154).

Current list of marine mammal species/stocks injured/killed ((1) indicates those stocks driving the fishery's classification): Bottlenose dolphin, Eastern GMX coastal; Bottlenose dolphin, GMX bay, sound, estuarine; Bottlenose dolphin, Northern GMX coastal(1); Bottlenose dolphin, Western GMX coastal (1).
Gear description/method for fishing: This fishery uses purse seine gear. All catch is processed at the "mother ship."

Target species: Menhaden and thread herring.

Spatial/temporal distribution of effort: This fishery operates in bays, sounds, and nearshore coastal waters along the GMX coast. ~~-~~The majority of the fishing effort is concentrated off Louisiana and Mississippi, with lesser effort in Alabama and Texas state waters.

Management and regulations: Florida prohibits the use of purse seines in state waters. ~~-~~This fishery is managed under the Gulf States Marine Fisheries Commission Interstate Gulf Menhaden Fishery Management Plan.

Levels of observer coverage each year: Observed in 1992, 1994, and 1995 through an observer program conducted by Louisiana State University. ~~–~~There has been no observer coverage since 1995. ~~–~~There was a pilot observer program conducted in 2011.

~~This fishery operates in coastal waters along the Gulf coast, with the majority of fishing effort concentrated off Louisiana and Mississippi. Fishing effort occurs both in bays, sounds, and in nearshore coastal waters. Between 1994 and 1998, fishery effort averaged approximately 23,000 sets annually (Smith *et al.* 2002). No observer data is available for the Gulf of Mexico Menhaden Fishery; however, recent interactions with bay, sound and estuary and coastal bottlenose dolphins have been reported through the MMAP and historically through an observer program~~

carried out by Louisiana State University from 1994 to 1996. Takes reported through the MMAP likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; Mississippi River Delta Stock; and Barataria Bay Estuarine System Stock. The fishery has been defined as a Category II fishery in the 20122011 List of Fisheries (76 FR 73912;November 29, 2011).(75 FR 68468, November 8, 2010).

Gulf of Mexico Gillnet Fishery

Current category: Category II

Basis for current classification on the LOF: Primarily by analogy with other Category I and II Atlantic gillnet fisheries, as well as stranding data Gulf of Mexico (GMX) bottlenose dolphin stocks showing signs of interaction with gillnets, and a recommendation from the Atlantic Scientific Review Group (SRG) to elevate unless there were data to the contrary.

Current list of marine mammal species/stocks injured/killed: Bottlenose dolphin, Eastern GMX coastal; Bottlenose dolphin, GMX bay, sound, and estuarine; Bottlenose dolphin, Northern GMX coastal; Bottlenose dolphin, Western GMX coastal.

Gear description/method for fishing: This fishery uses any type of gillnet configuration, including strike and straight gillnets.

Target species: This fishery targets a wide variety of target species, including, but not limited to: black drum, sheepshead, weakfish, mullet, spot, croaker, king mackerel, Spanish mackerel, Florida pompano, flounder, shark, menhaden, bluefish, blue runner, ladyfish, spotted seatrout, croaker, kingfish, and red drum.

Spatial/temporal distribution of effort: -This fishery operates year-round in waters north of the U.S.-Mexico border and west of the fishery management council demarcation line between the Atlantic Ocean and the Gulf of Mexico. Gillnets are currently prohibited in Texas and Florida state waters. –Mississippi currently has no state permits available for gillnet fisheries.

Management and regulations: Gillnet gear is prohibited in Texas and Florida state waters, but fixed and runaround gillnets are currently used in Louisiana and Alabama with highly variable fishing effort. Fishing for king mackerel, Spanish mackerel, cobia, cero, little tunny, dolphin fish, and bluefish are managed under the Coastal Migratory Pelagic Resources Fishery Management Plan (CMPR FMP).- In the Gulf of Mexico, CMPR FMP species are the only federally managed species for which gillnet gear is authorized, and only run-around gillnetting for these species is allowed. In state waters, state and Gulf States Marine Fisheries Commission Interstate FMPs apply. –Furthermore, Texas state does use gillnets for research that have associated takes of bottlenose dolphins.

Levels of observer coverage each year: -There has not been observer coverage in this fishery.

The Gulf of Mexico gillnet fishery uses strike and straight gillnets to target a wide variety of species including, but not limited to, black drum, sheepshead, weakfish, mullet, spot, croaker, king mackerel, Spanish mackerel, Florida pompano, flounder, shark, menhaden, bluefish, blue runner, ladyfish, spotted seatrout, croaker, kingfish, and red drum. This fishery operates year-round in waters north of the U.S. Mexico border and west of the fishery management council demarcation line between the Atlantic Ocean and the Gulf of Mexico. Gillnets are not used in Texas, and large gillnets were excluded from Florida state waters after July 1995, but fixed and runaround gillnets are currently in use in Louisiana, Mississippi, and Alabama. In the Gulf of Mexico, coastal migratory pelagic resources are the only federally managed species for which gillnet gear is authorized, and only run-around gillnetting for these species is allowed (CMPR FMP). In state waters, state and Gulf States Marine Fisheries Commission (GSMFC) Interstate FMPs apply. No marine mammal mortalities associated with commercial gillnet fisheries have been reported in these states, but stranding data suggest that marine mammal interactions with gillnets do occur, causing mortality and serious injury. There are no effort or observer data available for these fisheries. Four mortalities of bottlenose dolphins resulted from gillnet entanglements in Texas and Louisiana during 2003,

~~2004, 2006, and 2007Four research related gillnet mortalities occurred between 2003 and 2007 in Texas and Louisiana and an additional research gillnet entanglement (released alived) occurred during 2008 in Texas. The 3 Texas mortalities were a result of fisheries sampling and research by Texas Parks and Wildlife, and the Louisiana mortality (2006) occurred during a gulf sturgeon research project for the Army Corps of Engineers. All of the research related interactions were likely with animals belonging to the following bay, sound and estuary stocks: Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock (2 mortalities); Mississippi River Delta Stock (1 mortality); and Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock (1 mortality, 1 released alive). The Gulf of Mexico Gillnet Fisheries are listed as Category II fisheries in the 2011 List of Fisheries (76 FR 73912;November 29, 2011).(75 FR 68468, November 8, 2010).~~

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Figure 5. 2011 Northeast sink gillnet observed hauls (A) and observed takes (B).

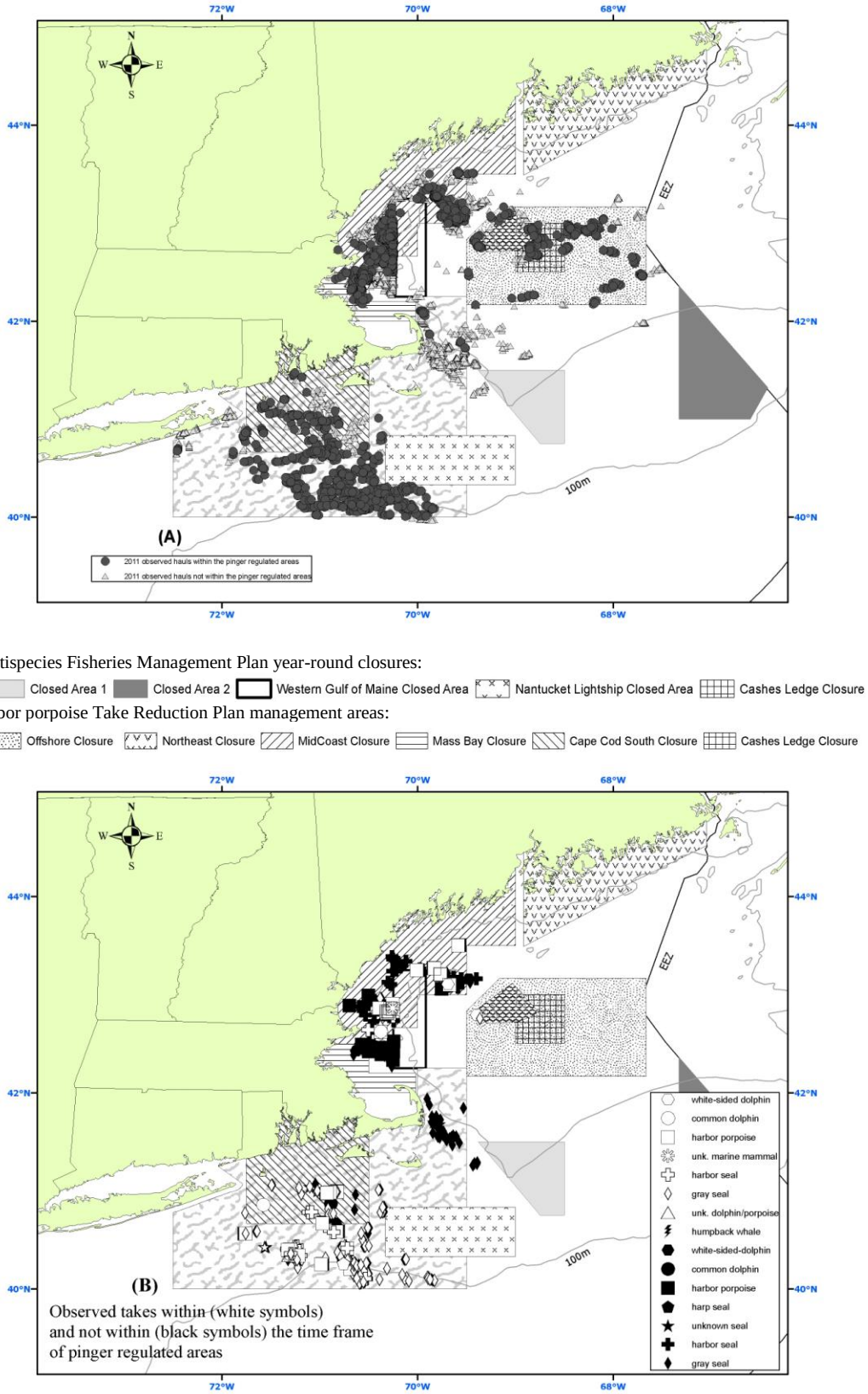
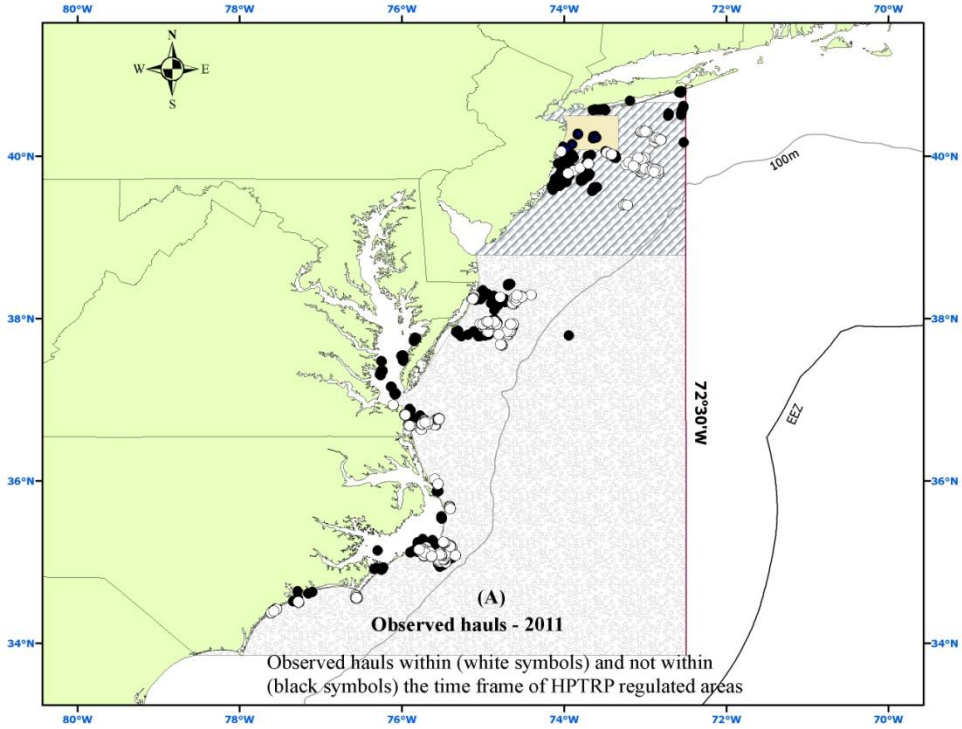


Figure 10. 2011 Mid-Atlantic gillnet observed hauls (A) and observed takes (B).



Harbor porpoise Take Reduction Plan management areas:

Southern mid-Atlantic waters | New Jersey Mudhole | waters off New Jersey

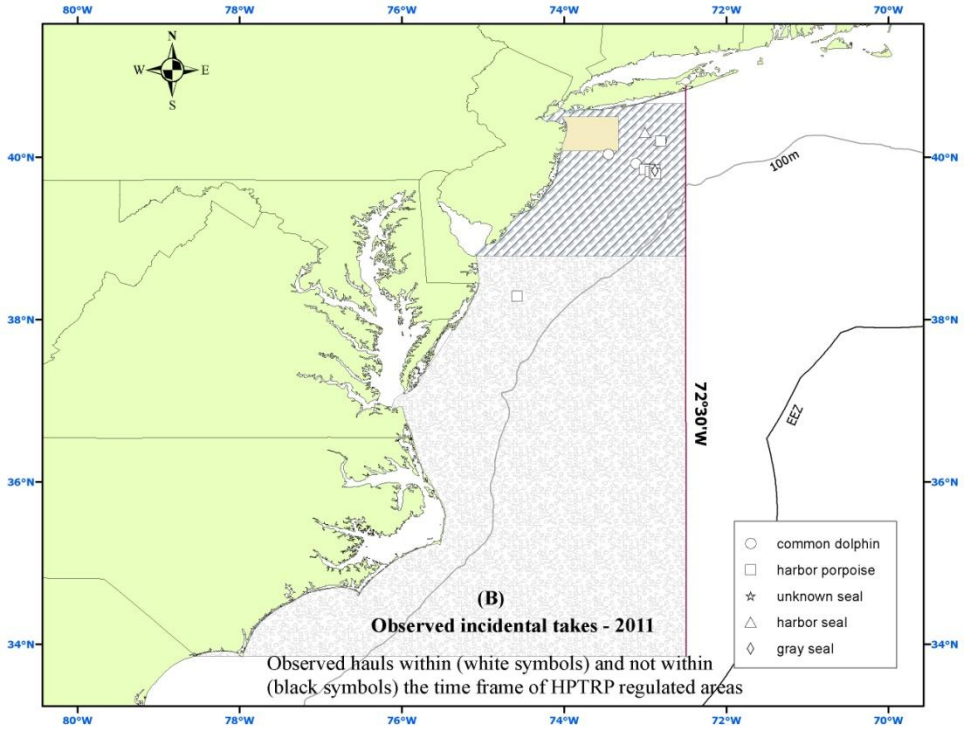


Figure 15. 2011 Mid-Atlantic bottom trawl observed tows (A) and observed takes (B).

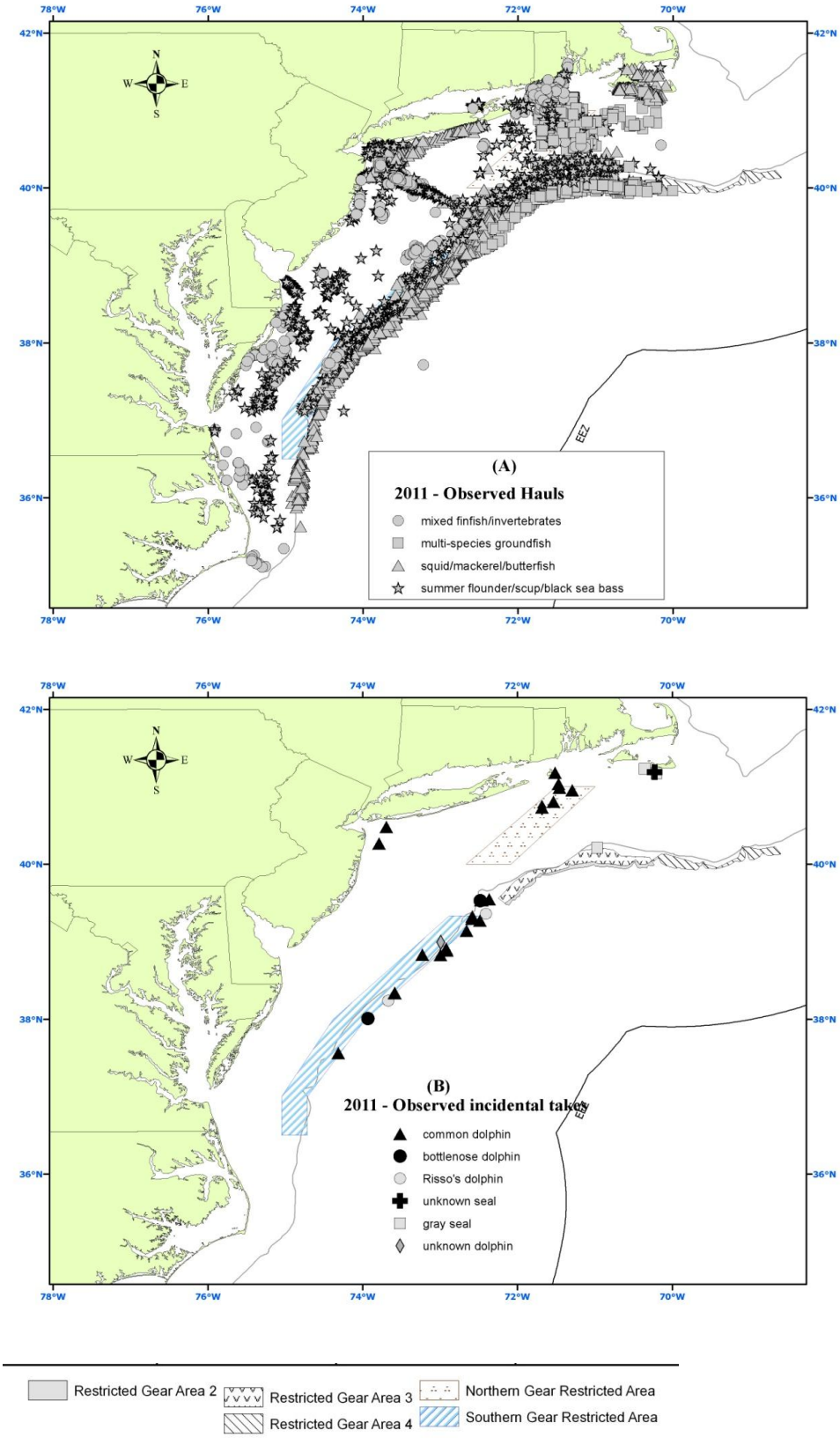
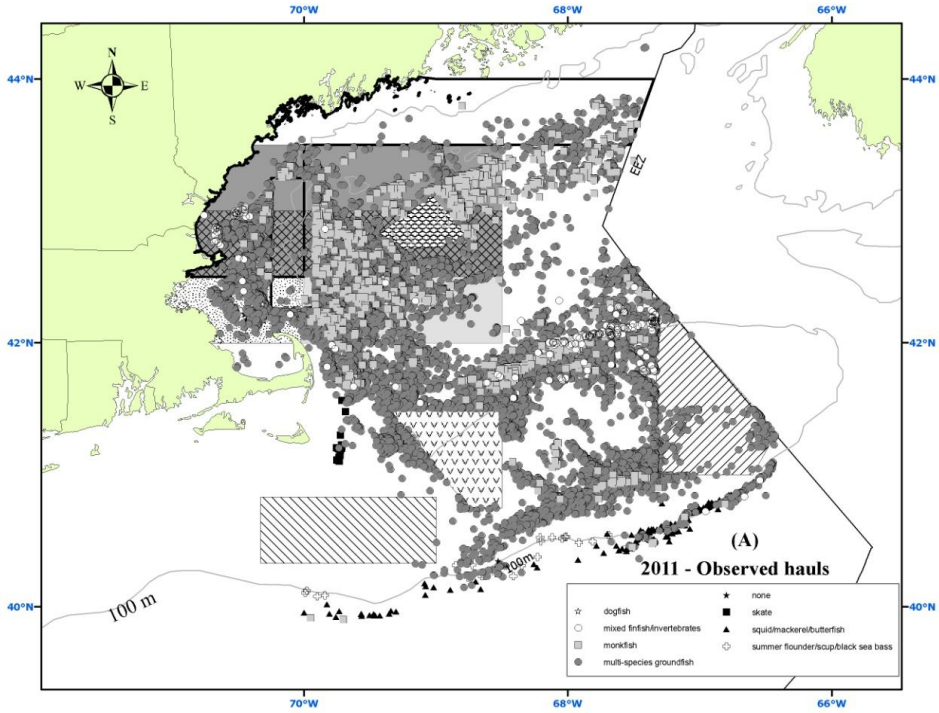
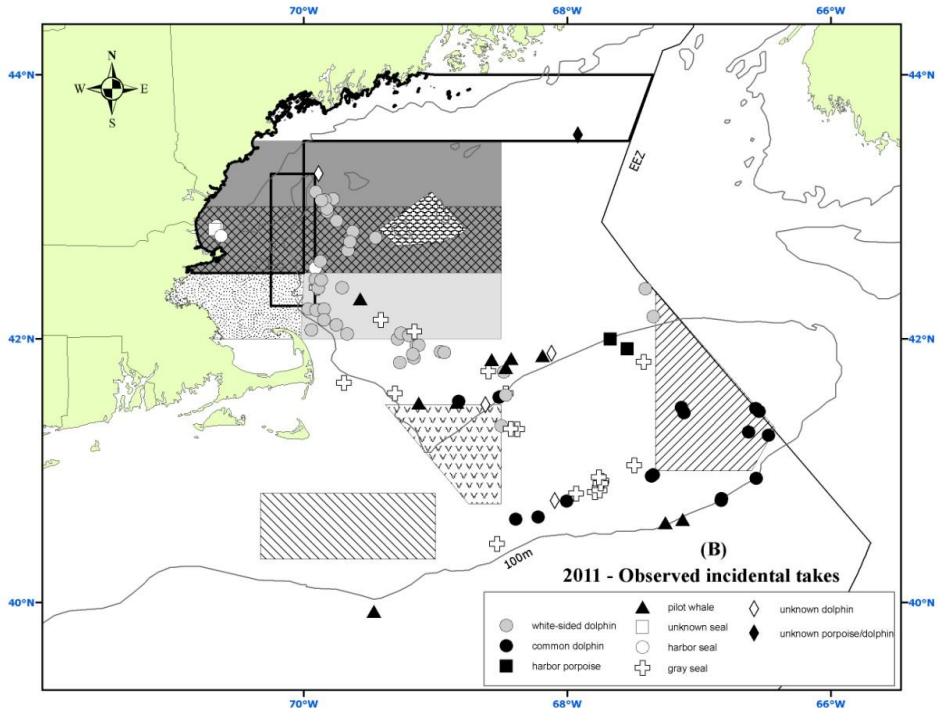


Figure 20. 2011 Northeast bottom trawl observed tows (A) and observed takes (B).





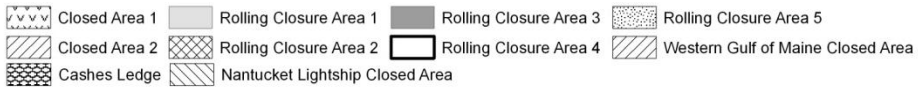


Figure 25. 2011 Northeast mid-water trawl observed tows (A) and observed takes (B).

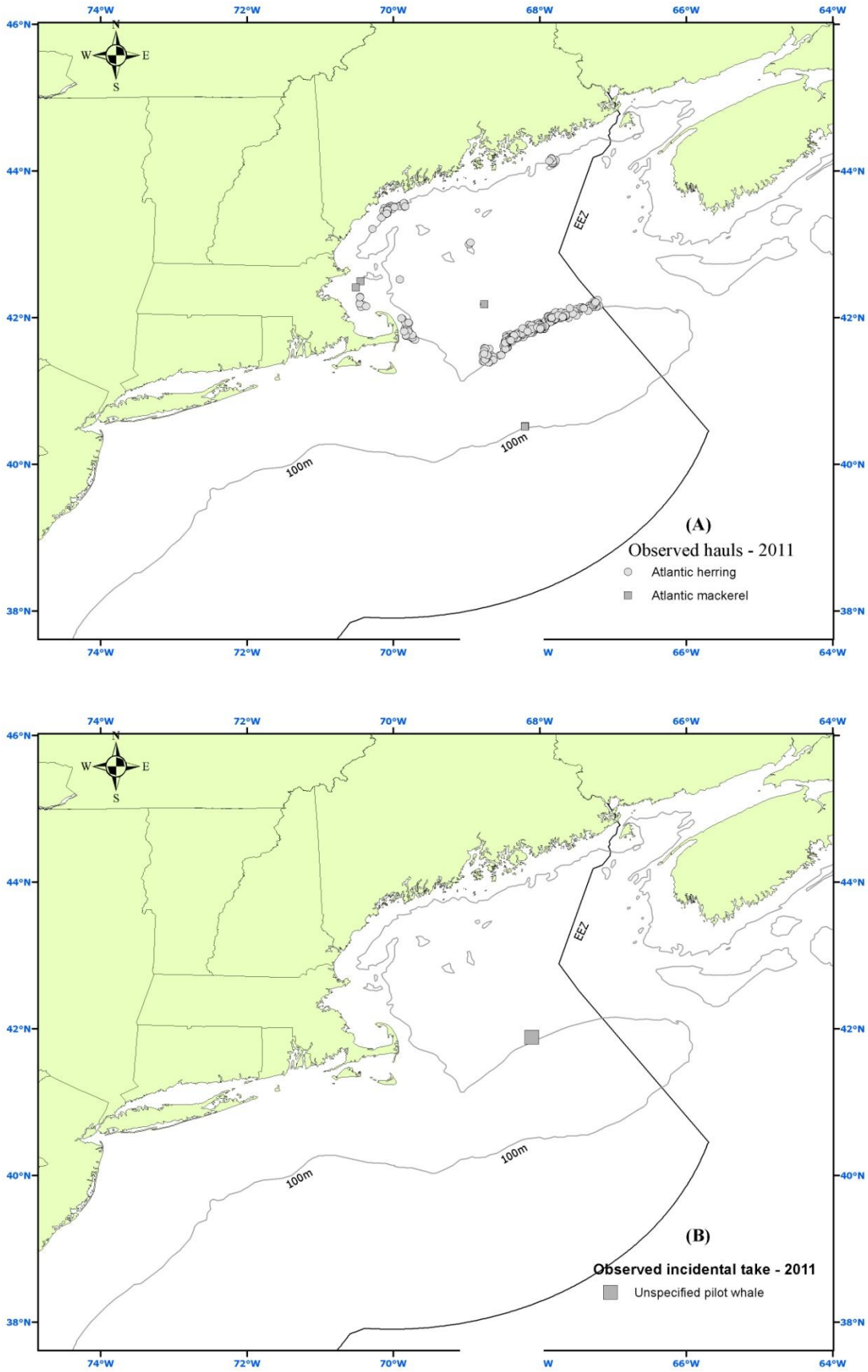
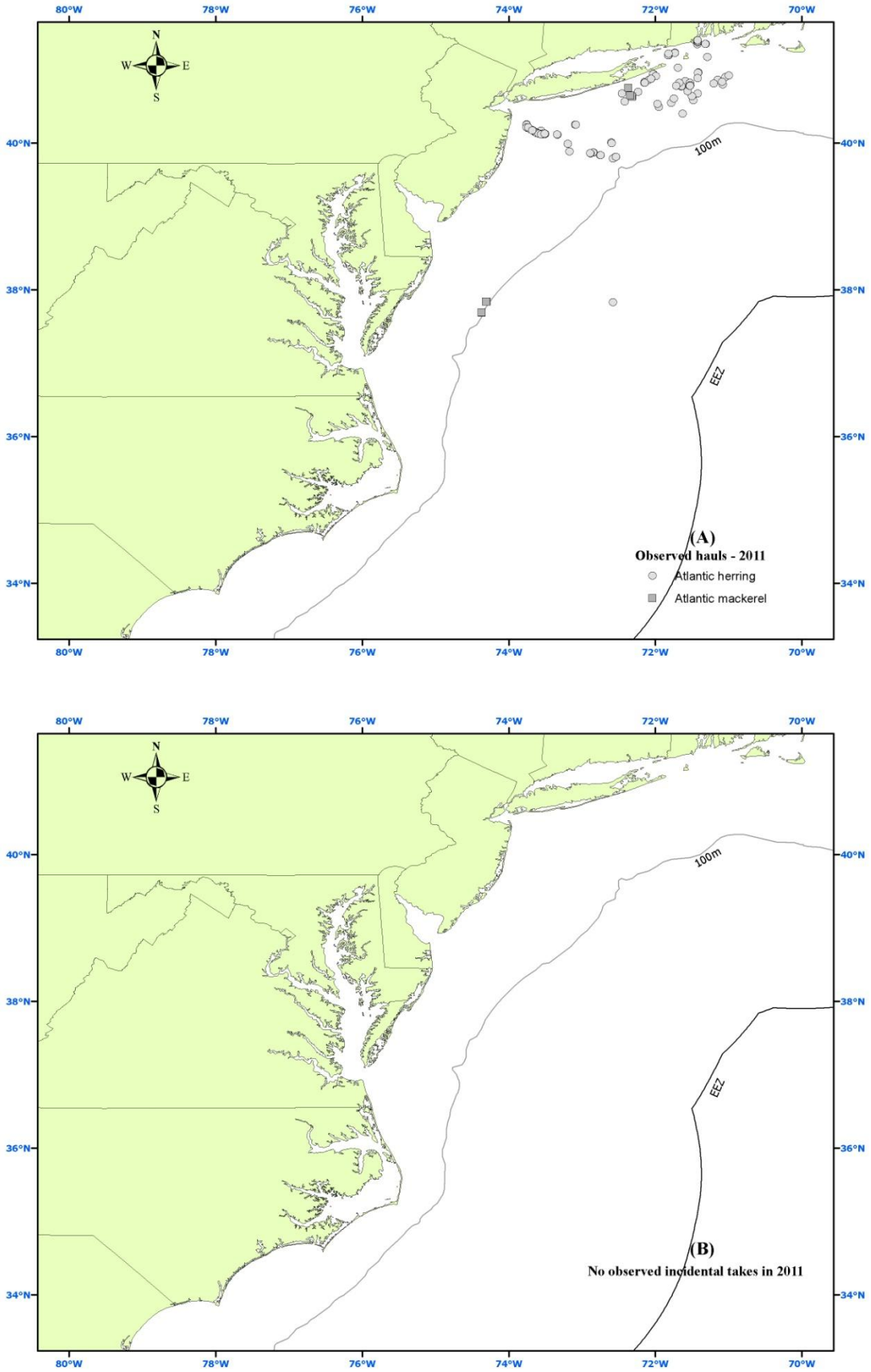


Figure 30. 2011 Mid-Atlantic mid-water trawl observed tows (A) and observed takes (B).



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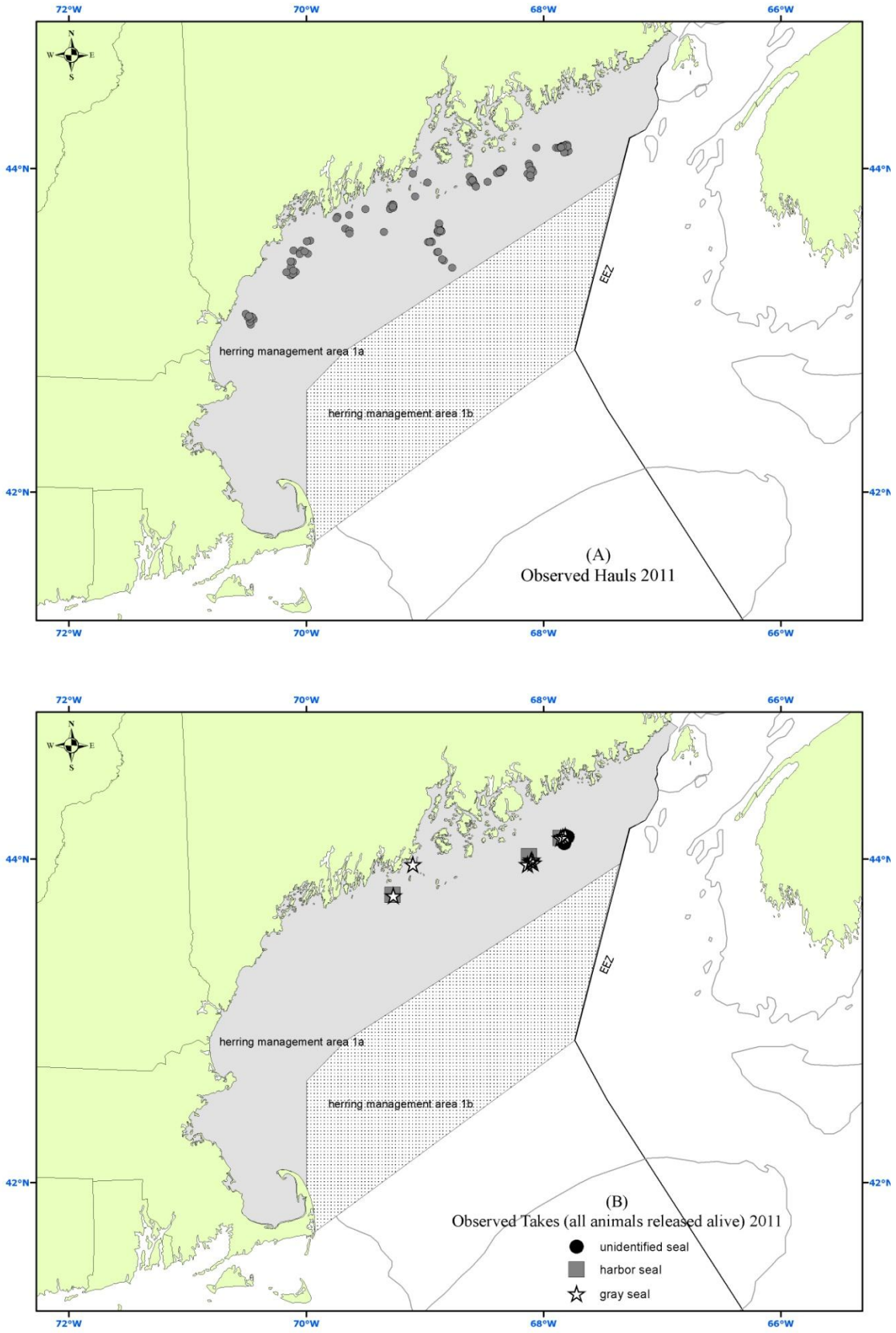

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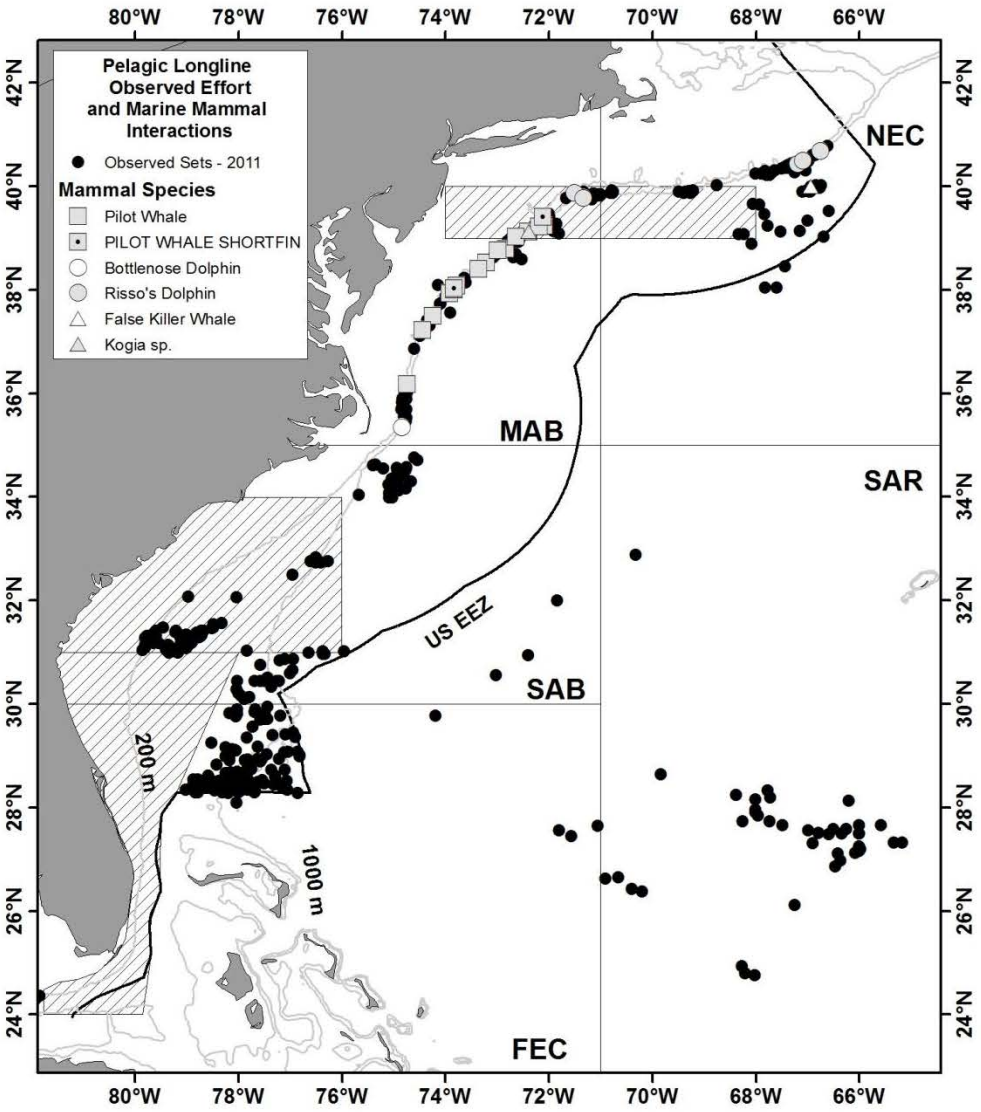
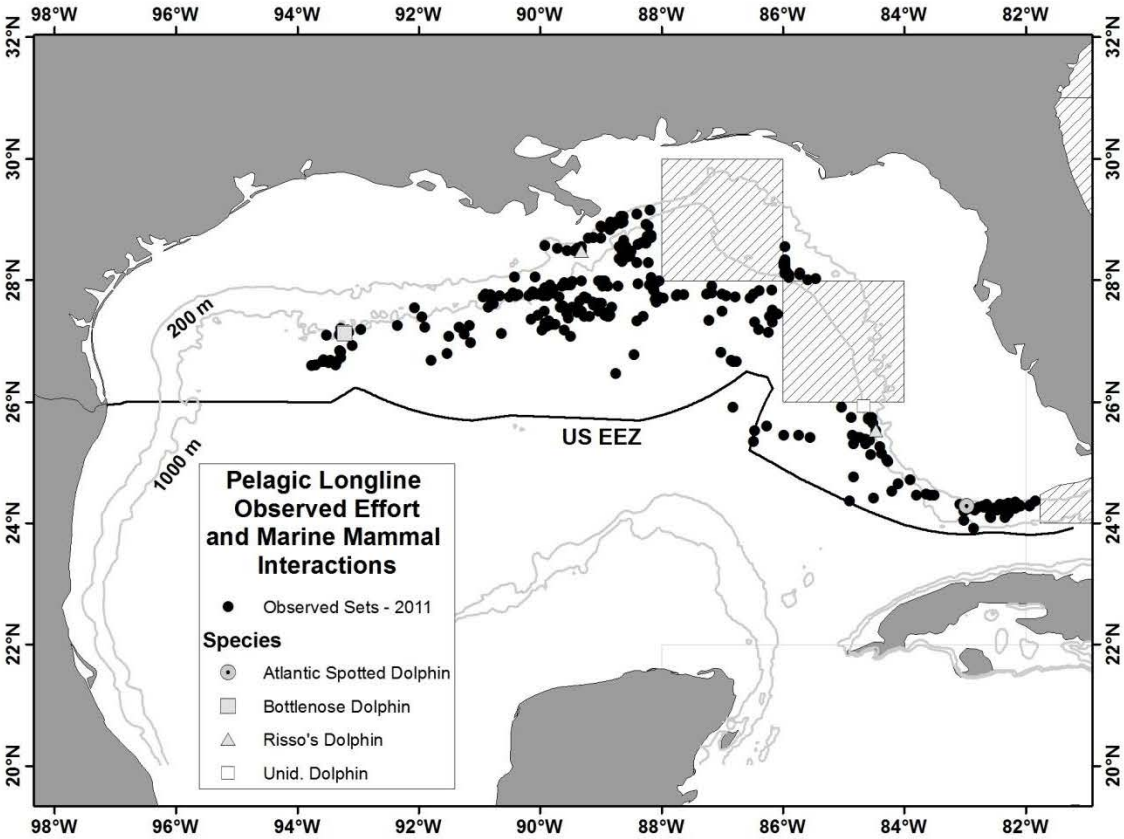
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