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~~December 2009~~~~January~~March 2010

HARBOR PORPOISE (*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 Program. 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 the northern edge of 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).

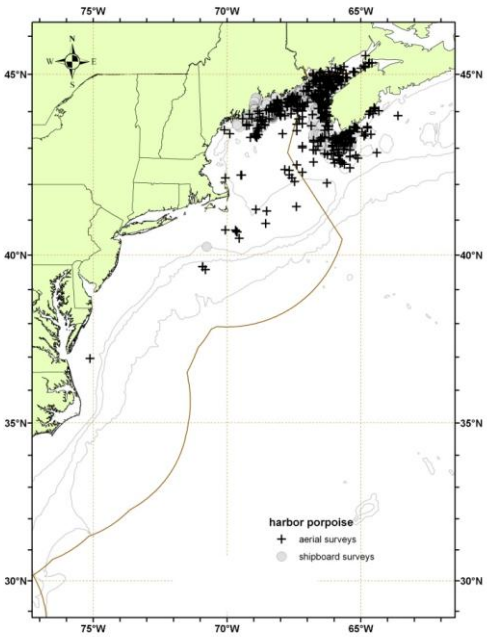

Figure 1. *Distribution of harbor porpoises from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006 and 2007. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

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. ~~Recent a~~Analyses involving mtDNA (Wang *et al.* 1996; Rosel *et al.* 1999a; Rosel *et al.* 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 in 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, eight line-transect sighting surveys were conducted during the summers of 1991, 1992, 1995, 1999, 2002, 2004, 2006, and 2007. The best current abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is 89,054 (CV=0.47), based on the 2006 survey results (Table 1). This is because the 2006 estimate covered the largest portion of the harbor porpoise range.

An abundance estimate of 64,047 (CV=0.48) harbor porpoises was derived from an aerial survey conducted in August 2002 which 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). The value of g(0) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.

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 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 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 abundance estimate of 89,054 (CV=0.47) harbor porpoises 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.).

An abundance estimate of 4,862 (95%CI=2,204-8,801) harbor porpoises from the Gulf of Maine/Bay of Fundy, Gulf of ~~Saint~~ St. Lawrence, and Newfoundland stocks was generated from the Canadian Trans North Atlantic Sighting Survey (TNASS) in July-August 2007. This aerial survey covered 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, 2009 #1069}

Table 1. Summary of recent abundance estimates for the Gulf of Maine/Bay of Fundy harbor porpoise. 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
Aug 2002	S. Gulf of Maine to Maine	64,047	0.48
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	Northern Labrador-Scotian Shelf	4,862	0.31

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 harbor porpoises is 89,054 (CV=0.47). The minimum population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 60,970.

Current Population Trend

A 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 60,970. 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 703.

ANNUAL HUMAN-CAUSED MORTALITY

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 4).

The total annual estimated average human-caused mortality is 9~~40~~28~~860~~+ (CV=0.16~~2~~) harbor porpoises per year. This is derived from four components: 8~~89~~77~~07~~ harbor porpoise per year (CV=0.1~~6~~5~~2~~) from most U.S. fisheries using observer and MMAP data, an unknown number for the Northeast bottom trawl fishery, 45 per year (unknown CV) from Canadian fisheries using observer data, and 6~~7.5~~ per year from unknown U.S. fisheries using strandings data.

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, Northeast bottom trawl and in the Canadian Bay of Fundy groundfish sink gillnet and herring weir fisheries (Table 2). Detailed U.S. fishery information is reported in Appendix III.

Earlier Interactions

One harbor porpoise was observed taken from 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.

U.S.

Northeast Sink Gillnet

In 1984 the Northeast sink gillnet fishery was investigated by a sampling program that collected information concerning marine mammal bycatch. Approximately 10% of the vessels fishing in Maine, New Hampshire, and Massachusetts were sampled. Among the 11 gillnetters who received permits and logbooks, 30 harbor porpoises were reported caught. It was estimated, using rough estimates of fishing effort, that a maximum of 600 harbor porpoises were killed annually in this fishery (Gilbert and Wynne 1985; Gilbert 1987).

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 during 1990-2007 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, ~~and~~ 395 (0.37) in 2007, and ~~720~~666 (0.48) in 2008 (Table 2). 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.

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 2004~~3~~ to 2008~~7~~ was 5~~8~~372~~57~~ (0.17~~4~~) (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 were 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, ~~and~~ 58 (1.03) in 2007, and 35~~3~~0 (0.7~~6~~5) in 2008. 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 ~~2003~~ 2004 to 2008~~7~~ was ~~250~~ 30~~6~~5 (0.~~26~~3427) (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. ~~Nineteen~~ Twenty harbor porpoise mortalities were observed in the Northeast bottom trawl fishery between 1989 and ~~2007~~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, ~~and~~ 1 in 2006, and 1 in 2008. Estimates have not been generated for this fishery.

Unknown Fishery

The strandings and entanglement database, maintained by the New England Aquarium and the Northeast Regional Office/NMFS, reported 228, 27, 113, 79, 122, 118, 174, 73, ~~and~~ 79, and 58 stranded harbor porpoises on U.S. beaches during 1999 to ~~2007~~2008, respectively (see Other Mortality section for more details). Of these, it was determined that the cause of death of 19, 1, 3, 2, 9, and 6 stranded harbor porpoises in 1999 to 2004, respectively, were due to unknown fisheries and these animals were in areas and times that were not included in the above

mortality estimate derived from observer program data (Table 3). As of 2005, the cause of death of stranded animals is not being evaluated and so will not be included in annual human-induced mortality estimates. The ~~two-year average~~ harbor porpoise mortality and serious injury in this unknown fishery category f~~r~~orm ~~2003 to~~ 2004 is 6.0~~7.5~~ (CV is unknown).

CANADA

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. No harbor porpoises were observed taken.

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.

More recently, 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 September 1-7. 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 was 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~~2003-2007 removals~~.

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, ~~an~~ additional ~~751~~ harbor porpoises have been documented in Canadian herring weirs where the number of ~~, of which 687 were released or escaped, 41 died, and 23 had an unknown status. M~~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 and 0 (8, 6) in 2008 (Neimanis *et al.* 2004; H. Koopman

and A. Westgate, pers. comm.).

Average estimated harbor porpoise mortality in the Canadian herring weir fishery during 2004~~3~~-2008~~7~~ was 1.8~~2.0~~ (Table 2). An estimate of variance is not possible.

Gulf of St. Lawrence gillnet

This fishery interacts with the Gulf of St. Lawrence harbor porpoise stock, not the Gulf of Maine/Bay of Fundy harbor porpoise stock. Using questionnaires to fishermen, Lesage *et al.* (2006) determined a total of 2215 (95% CI 1151-3662) and 2394 (95% CI 1440-3348) harbor porpoises were taken in 2000 and 2001, respectively. The largest takes were in July and August around Miscou and the North Shore of the Gulf of St. Lawrence. According to the returned questionnaires, the fish species most usually associated with incidental takes of harbor porpoises include Atlantic cod, herring and mackerel. An at-sea observer program was also conducted during 2001 and 2002. However, due to low observer coverage that was not representative of the fishing effort, Lesage *et al.* (2006) concluded that resulting bycatch estimates were unreliable.

Newfoundland gillnet

This fishery interacts with the Newfoundland harbor porpoise stock, not the Gulf of Maine/Bay of Fundy harbor porpoise stock. Estimates of incidental catch of small cetaceans, where the vast majority are likely harbor porpoises was 862 in 2001, 1,428 in 2002, and 2,228 in 2003 for the Newfoundland nearshore cod and Greenland halibut fisheries, and the Newfoundland offshore fisheries in lumpfish, herring, white hake, monkfish and skate (Benjamins *et al.* 2007) .

Table 2. From observer program data, summary of the incidental mortality of harbor porpoise (*Phocoena phocoena*) 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 Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
U.S.							
Northeast Sink Gillnet[c]	~~03~~04-~~07~~08	Obs. Data, Weighout, Trip Logbook	~~.03,~~ .06, .07, .04, .07, .05	~~12[e],~~ 27[e], 51[e], 26, 35, 30	~~592,~~ 654[e], 630[e], 514, 395, ~~720~~666	~~.33,~~ .36, .23, .31, .37, .48	~~5575~~8372 (~~0.14~~0.17)
Mid-Atlantic Gillnet	~~03~~04-~~07~~08~~4~~	Obs. Data Weighout	~~.01,~~ .02, .03, .04, .06, .03	~~1,~~ 2, 15, 20, 1, 9	~~76,~~ 137, 470, 511, 58, 35~~3~~0	~~1.13,~~ .91, .51, .32, 1.03, .76~~5~~	~~250~~3065 (0.~~26~~3427)
Northeast bottom trawl[g]	~~03~~04-~~07~~08~~4~~	Obs. Data Weighout	~~.04,~~ .05, .12, .06, .06, .08	~~1,~~0,4,1, 0, 1	~~unk[i],~~0,unk[i], unk, 0, unk	~~unk,~~ 0, unk, unk, 0, unk	unk[i,g]
U.S. TOTAL	2004~~3~~-2008~~7~~						8~~89~~770~~7~~ (0.16~~5~~2)
CANADA							
Bay of Fundy Sink Gillnet[f]	1997-2001~~07~~	Can. Trips	unk	19, 5, 3, 5, 39	43~~34~~, 38, 32, 28, 73	unk	43[f] (unk)
Herring Weir	04~~3~~-08~~7~~	Coop. Data	unk	~~1,~~ 4, 0, 2, 3, 0	~~1,~~ 4, 0, 2, 3, 0	NA	1.8~~2.0~~ (unk)
CANADIAN TOTAL	2004~~3~~-2008~~7~~						45 (unk)
GRAND TOTAL							9~~3~~422~~850~~+ (unk)

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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, 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. O~~The o~~bserver coverage~~s~~ for the ~~U.S. and Canadian sink gillnet fisheryies~~ is~~are ratios based on trips, and for the~~ U.S. Northeast and mid-Atlantic coastal gillnet fisheries~~y~~, ~~the coverage unit of effort~~ is based on tons of fish landed.

c. During 2002-2008 in the Northeast gillnet fishery~~7~~, 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, ~~and~~ 9 and 6 observed harbor porpoise takes on pinger trips from 1992 to 2008~~7~~, 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, ~~and~~ 7, and 13 observed harbor porpoise takes in 1995 to 2008~~7~~, respectively, on trips dedicated to fish sampling versus dedicated to watching for marine mammals; these were also included in the observed mortality column (Bisack 1997).

d. There were 255 licenses for herring weirs in the Canadian Bay of Fundy region.

e. There were 22 active weirs around Grand Manan. The number of weirs elsewhere is unknown.

f~~h~~. The Canadian gillnet fishery was not observed during 2002 and afterwards, but the fishery is still active; thus, the bycatch estimate is estimated using past averages.

g~~i~~. Estimates of bycatch mortality attributed to the Northeast bottom trawl fishery have not been generated.

Table 3. From strandings and entanglement data, summary of confirmed incidental mortality of harbor porpoises (*Phocoena phocoena*) by fishery: includes years sampled (Years), ~~number of vessels active within the fishery (Vessels),~~ type of data used (Data Type), mortalities assigned to this fishery (Assigned Mortality), and mean annual mortality.

Fishery	Years	Data Type [a]	Assigned Mortality	Mean Annual Mortality
Unknown gillnet fishery	~~03~~04-~~07~~08	Entanglement & Strandings	~~9,~~ 6, unk[b], unk[b], unk[b], unk[b]	~~7.5~~6
TOTAL				~~7.5~~6

NA=Not Available.

a Data from records in the entanglement and strandings data base maintained by the New England Aquarium and the Northeast Regional Office/NMFS (Entanglement and Strandings).

b. As of 2005, the cause of death of stranded animals is not being evaluated and so will not be included in annual human-induced mortality estimates. Thus, the annual mortality is ~~an~~that from ~~average from the years 2003~~ 2004.

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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 2003, 122 harbor porpoises were reported stranded (Table 4). The number of reported fishery interactions by state are: 1 in Massachusetts (October), 1 in Maryland (March), 6 in Virginia (3 in March, 2 in April, and 1 in May), and 1 in North Carolina (February). Three harbor porpoises were reported mutilated in North Carolina. All of these strandings reported with fishery interactions were in areas and times that were not part of a bycatch estimate derived from the observer data (Table 3).

During 2004, 117 harbor porpoises were reported stranded on Atlantic US beaches. There were 8 reported fishery interactions by state: 1 in Massachusetts (May), 1 in New York (May), and 3 in Virginia (February, March, and April), and 3 in North Carolina (April). In addition, there was 1 mutilation in Delaware during March. Of these 8 fishery interactions, six were in areas and times that were not part of a bycatch estimated derived from the observer data (Table 3).

During 2005, 175 harbor porpoises were reported stranded on Atlantic US beaches. Although 24 animals were classified as having signs of human interaction, and of those 24, 7 showed signs of fishery interaction, in no case was cause of death directly attributable to these interactions. An Unusual Mortality Event was declared for harbor porpoise in North Carolina, as there were 38 stranded in that state between 1 January and 28 March 2005. Most of these were young of the year, and histopathological examinations of 6 of these animals showed no– systemic diseases or common symptoms other than emaciation or any systemic disease (MMC 2006).

During 2006, 73 harbor porpoises were reported stranded on Atlantic US 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 US 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 US beaches. Of these, four were reported as having signs of human interaction. One of these was classified as a fishery interaction.

As of 2005, the cause of death of stranded animals is not being evaluated and so will not be included in annual human-induced mortality estimates. Using onlyAveraging 2003 to 2004, it is estimated that there were 7.56 animals per year that were stranded and mutilated and so cause of death was attributed to an unknown human-caused mortality (Table 3).

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 4. Harbor Porpoise (*Phocoena phocoena*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2003-2007.

Area	Year					Total
	2003	2004	2005	2006	2007	
Maine	5	15	9	9	10	**48**
New Hampshire	2	2	0	1	0	**5**
Massachusetts[a]	35	49	55	23	22	**184**
Rhode Island[b]	2	3	6	3	1	**15**
Connecticut	0	0	1	0	0	**1**
New York[c]	8	8	15	11	10	**52**
New Jersey	5	14	17	6	5	**47**
Pennsylvania	0	0	1	0	0	**1**
Delaware	1	1	3	3	3	**11**
Maryland	5	2	4	2	0	**13**
Virginia	19	8	22	9	8	**66**
North Carolina[d]	39	15	42	6	20	**122**

~~Florida~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~**TOTAL U.S.**~~	~~**122**~~	~~**117**~~	~~**175**~~	~~**73**~~	~~**79**~~	~~**566**~~
~~Nova Scotia~~	~~3~~	~~4~~	~~6~~	~~4~~	~~4~~	~~21~~
~~**GRAND TOTAL**~~	~~**125**~~	~~**121**~~	~~**181**~~	~~**77**~~	~~**83**~~	~~**587**~~

~~a. In Massachusetts, during 2005, 2 animals were relocated and released. In 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.~~
~~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 relocated and released in 2005, and one was taken to rehab in2003 and one in 2006. The 2003 animal was tagged and released (Schofield *et al.* 2008).~~

Table 4. Harbor Porpoise (*Phocoena phocoena*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2004-2008.

Area	Year					**Total**
	2004	2005	2006	2007	2008	
Maine[a]	15	9	9	10	7	**50**
New Hampshire	2	0	1	0	0	**3**
Massachusetts[ab]	49	55	23	22	25	**174**
Rhode Island[be]	3	6	3	1	1	**14**
Connecticut	0	1	0	0	0	**1**
New York[ce]	8	15	11	10	3	**47**
New Jersey	14	17	6	5	8	**50**
Pennsylvania	0	1	0	0	0	**1**
Delaware	1	3	3	3	0	**10**
Maryland	2	4	2	0	2	**10**
Virginia	8	22	9	8	6	**53**
North Carolina[d]	15	42	6	20	6	**89**
Florida	0	0	0	0	0	**0**
TOTAL U.S.	**117**	**175**	**73**	**79**	**58**	**502**
Nova Scotia	3	5~~4~~	4~~6~~	4	6	~~**16**~~**22**~~**7**~~
Newfoundland and New Brunswick	0	5	0	1	4	**10**
GRAND TOTAL	**120**	**185~~4~~**	**77~~9~~**	**84**	**62**	**5~~28~~34~~9~~**

a. In Massachusetts, during 2005, 2 animals were relocated and released. In 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 relocated and released in 2005, ~~and~~ one animal was taken to rehab ~~in2003 and one~~ in 2006, and one animal immediately released in 2008. ~~The 2003 animal was tagged and released (Schofield *et al.* 2008).~~

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded between 1991 and 1996 on the

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coast of Nova Scotia (Hooker *et al.* 1997). Researchers with the Canadian Department~~t.~~ 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 between 1997 and ~~2007~~ 2008 on the coast of Nova Scotia as recorded by the Marine Animal Response Society and the Nova Scotia Stranding Network are as follows (Table 4): 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), ~~and~~ 4 in 2007, and ~~xx~~6 in 2008 (Table 4).

FFive dead stranded harbor porpoises were reported in 200~~8~~5 by the Newfoundland and Labrador Whale Release and Strandings Program, 1 in 2007 and 4 in 2008. (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009~~(Ledwell 2009)~~

USA management measures taken to reduce bycatch

A ruling to reduce harbor porpoise bycatch in USA 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 plan 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. NMFS is currently undertaking rule-making to modify the plan.

STATUS OF STOCK

The status of harbor porpoises, relative to OSP, in the U.S. Atlantic EEZ is unknown. On 7 January 1993, the National Marine Fisheries Service (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). Population trends for this species have not been investigated. 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. This is a strategic stock because average annual human-related mortality and serious injury exceeds PBR.

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~~December 2009~~~~January 2010~~March 2010

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are ~~two~~2 species of pilot whales in the western Atlantic—the ~~Atlantic or~~ long-finned pilot whale, *Globicephala melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea; therefore, the ability to separately assess the ~~two~~2 stocks in U.S. Atlantic waters is limited. ~~These species are difficult to differentiate at sea; therefore, some of the descriptive material below refers to *Globicephala* sp., and is identified as such.~~ 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; Buckland *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 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. ~~The species is considered to occur from Canada to Cape Hatteras. NMFS is currently conducting research to improve the understanding of species delineation and distribution.~~

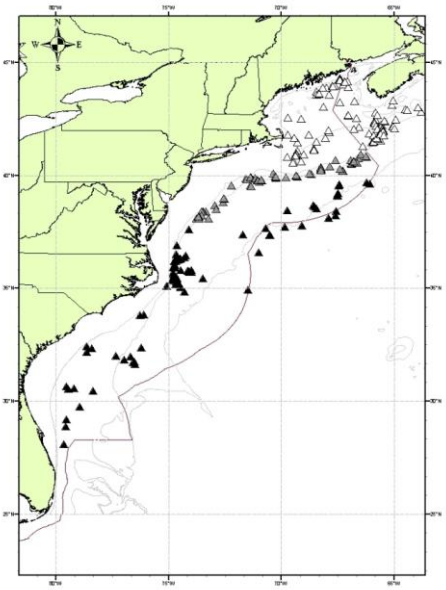

Figure 1. *Distribution of long-finned (open symbols), short-finned (black symbols), and possible mixed (gray symbols) pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006 and 2007. The inferred distribution of the two species is preliminary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

In U.S. Atlantic waters, p~~P~~ilot whales (*Globicephala* sp.) are distributed principally along the continental shelf edge off the northeast 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 ~~(Payne~~ (Payne and Heinemann 1993;Garrison *et al.* in review).

~~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 . The stock structure of the North Atlantic population is uncertain . Morphometric and genetic studies have provided little support for stock structure across the Atlantic . However, Fullard *et al.* 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.~~

POPULATION SIZE

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. Because long-finned and short-finned pilot whales are difficult to distinguish at sea, sighting~~s~~ data are reported as *Globicephala* sp.~~—~~. ~~S~~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 ~~two~~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 ~~two~~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)~~—~~. ~~Sightings were almost exclusively in the continental shelf edge and continental slope areas (Figure 1). Because long finned and short-finned pilot whales are difficult to distinguish at sea, seasonal abundance estimates are reported for *Globicephala* sp., both long-finned and short-finned pilot whales. The best abundance estimate for *Globicephala* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys. This joint estimate (15,728 + 15,411 = 31,139 whales) is considered best because these two surveys together have the most complete coverage of the species' habitat.~~

Earlier estimates

Please see appendix IV for earlier estimates and descriptions of abundance surveys~~—~~. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable and should not be used for PBR determinations. 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 which 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~~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 (27.5~~-~~ºN and 38ºN latitude) was conducted during June-August 2004. The survey employed ~~two~~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 ~~M~~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 ~~15,411~~21,056 animals (CV~~=~~=0.~~43~~54; Garrison *et al.*, in review).

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; Palka pers. comm.).

An abundance estimate of 6,134 (95% CI=2,774-10,573) pilot whales was ~~generated~~ 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).

Table 1. Summary of abundance estimates for the western North Atlantic *Globicephala* sp. 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	~~15,411~~21,056	0.~~43~~54
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	~~31,139~~36,784	0.~~27~~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

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 (Garrison *et al.*, in prep)~~.~~. 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 at water temperatures ~~less than~~< 22°C, the probability of a sample coming from a long-finned pilot whale~~s~~ was near 1, and at temperatures >25°C, this probability was near 0~~.~~. 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 ~~two~~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 ~~a~~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 northeast 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 review)~~.~~.

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 ~~*Globicephala* sp.~~western North Atlantic long-finned pilot whales is ~~31,139~~12,619 animals (CV~~=~~0.~~27~~37)~~ derived from the 2004 surveys.~~. 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. The minimum population estimate for ~~*Globicephala* sp. is 24,86~~long-finned pilot whales is 9,333.~~6.~~

Current Population Trend

There are insufficient data to determine population trends for *Globicephala* ~~sp.~~ *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 557-cm 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 ~~*Globicephala* sp.~~long-finned pilot whales is 9,333~~24,866~~. 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 ~~*Globicephala* sp. is 249. It is not possible to determine the PBR for only~~ long-finned pilot whale~~s~~ is 93~~.~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human caused mortality of long-finned pilot whales cannot be determined~~.—~~. The highest bycatch rates in the pelagic longline fishery area were observed during September – October ~~majority of observed mortality and serious injury to pilot whales is observed during October November~~ along the mid-Atlantic coast (Garrison 2007)~~.—~~. In bottom trawls, 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 is currently very little data available for the potential area of overlap during the fall~~.~~. T~~t~~herefore, it is not possible to partition mortality estimates between the ~~two~~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 are thus presented only for the ~~two~~2 species combined~~.—~~. Total annual estimated average fishery-related mortality or serious injury during 2004-2008 was 17~~5~~6 pilot whales (CV=0.14; Table 2)~~.—~~. Of this, it is most likely that the mortality due to the pelagic longline fishery, the N~~n~~ortheast midwater trawl fishery, and the N~~n~~ortheast groundfish fishery have the most direct impact on long-finned pilot whales.

~~Total annual estimated average fishery related mortality or serious injury to this stock during 2003-2007 was 166 pilot whales (CV=0.14); Table 2).~~

Fishery Information

Detailed fishery information is reported in Appendix III~~.—~~.

~~—~~Total fishery-related mortality and serious injury cannot be estimated separately for the ~~two~~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 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 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).

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 ~~one~~1 interaction, the net was pursed around ~~one~~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~~, 0~~ 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/~~M~~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 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/~~M~~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 included as a component of the mid-Atlantic bottom trawl fishery.

There was ~~one~~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 included as a component of the mid-Atlantic bottom 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).

Pelagic Longline

Most of the estimated marine mammal bycatch in the U.S. pelagic longline fishery was ~~from~~ rec~~ro~~orded 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). Pilot whales are frequently observed to feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). Between 1992 and ~~2007~~2008, ~~136~~ 154 pilot whales ~~(including 2 identified as short-finned pilot whales)~~ were released alive, including ~~78~~ 83 that were considered seriously injured, ~~(of which 1 was identified as a short-finned pilot whale),~~ and 5 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). 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 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 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. 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, ~~and~~ 57 (CV=0.47) in 2007, and 98 (CV=0.42) in 2008. The average 'combined' annual mortality in 2004-2008 was 122 pilot whales (CV=0.19) (Table 2)~~.-~~. ~~. The average 'combined' annual mortality in 2003-2007 was 110 pilot whales (CV=0.20) (Table 2).~~

An experimental fishery was conducted on 6~~six~~ vessels operating in the Gulf of Mexico and off the U.S. east coast in 2005, with 100% observer coverage achieved during this experimental fishery. 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 ~~one~~1 which was seriously injured (Fairfield Walsh and Garrison 2006).

Mid-Atlantic Bottom Trawl

Two pilot whales were observed taken in the ~~M~~mid-Atlantic bottom trawl in 2000, ~~four~~4 in 2005, ~~one~~1 in 2006, ~~and zero~~0 in 2007, and ~~zero~~0 in 2008. 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, ~~and~~ 36 (CV=0.38) in 2007, and 24 (CV=0.36) in 2008. The 2004-2008 average mortality attributed to the ~~M~~mid-Atlantic bottom trawl was 34 animals (CV=0.13).
~~. The 2003-2007 average mortality attributed to the Mid-Atlantic bottom trawl was 34 animals (CV=0.15).~~

Northeast Bottom Trawl

Two pilot whales were observed taken in the Northeast bottom trawl in 2004, ~~four~~4 in 2005, ~~one~~1 in 2006, ~~and four~~4 in 2007, and 5 in 2008. 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, ~~and~~ 12 (CV=0.35) in 2007 and 10 (CV=0.34) in 2008. The 2004-2008 average mortality attributed to the northeast bottom trawl was 15 animals (CV=0.13).~~. The 2003-2007 average mortality attributed to the northeast bottom trawl was 15 animals (CV=0.13).~~

Northeast Mid-Water Trawl (~~–~~Including Pair Trawl)

In Sept 2004 a~~A~~ pilot whale was observed taken in the paired~~single~~ mid-water trawl fishery on the northern edge of Georges Bank (off ~~of~~ Massachusetts) in a haul that was targeting (and primarily caught) herring~~ in 2004~~. 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. 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 ~~bycatch rate model used the 2003 to September 2007 observed mid-water trawl data, including~~ paired and single~~, and~~ Northeast ~~and Mmid-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~~. The VTR data were used to estimate the total effort~~ (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.~~ Estimated annual fishery-related mortalities were: unknown in 2001-2002, ~~1.9 (CV=0.56)~~0 in 2003, and 5~~.~~.~~3~~61.4 (CV=0.9~~8~~2~~58~~) in 2004, ~~1.1 (CV=0.68)~~0 in 2005 to~~, 0 in 2006, and 0 in~~ 2007-, and ~~6.513.1~~ 16 (CV=0.6~~0~~10~~.56~~) in 2008~~.~~ (Table 2; Palka pers. comm.). The average annual estimated mortality during 2004-2008 was ~~3.71~~4.3~~.8~~ (CV=0.51~~07~~).~~(Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during 2003-2007 was 1 (CV=0.35).~~

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

In March 2007 a~~No~~ pilot whale~~s~~ was~~ere~~ observed bycaught in the single mid-water~~is~~ fishery~~ between 2002 and~~

2006, or in 2008, though because of data pooling, estimates were still generated for some years 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 and mackerel were used.- The VTR herring and mackerel data were used to estimate the total effortthe bycatch rate model used the 2003 to September 2006 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. Estimated annual fishery-related mortalities were unknown in 2002, 0 in3.9 (CV=0.46) in 2003 , 8.1 (CV=0.38) in 2004, 7.5 (CV=0.76) in 2005, 0 in to 2006, and 11.2412.1.9 (CV=0.701.020.99) in 2007-, and 0 in 2008 (Table 2; Palka pers. com.). The average annual estimated mortality during 2004-2008 was 2.244 (CV=0.1.020.994).(Table 2; Palka pers. comm.). The average annual estimated fishery related mortality during 2003-2007 was 5 (CV=0.31).

CANADA

An unknown number 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 were 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 one1 record of incidental catch in the offshore Greenland halibut fishery that involved one1 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 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	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Mid-Atlantic Bottom Trawl[d]	03-07	unk	Obs. Data Dealer	.01, .03, .03, .02, .03	0, 0, 0, 0, 0	0, 0, 4, 1, 0	0, 0, 0, 0, 0	31, 35, 31, 37, 36	31, 35, 31, 37, 36	.31, .33, .31, .34, .38	34 (.15)
Northeast Bottom Trawl[d]	03-07	unk	Obs. Data Dealer Data VTR Data	04, .05, .12, .06, .06	0, 0, 0, 0, 0	0, 0, 2, 4, 1, 4	0, 0, 0, 0, 0	20, 15, 15, 14, 12	20, 15, 15, 14, 12	, .26, .29, .30, .28, .35	15 (.13)

~~Mid-Altlantic Mid-Water Trawl - Including Pair Trawl[c]~~	~~03-07~~	~~23, 25, 31, 23, 14~~	~~Obs. Data Dealer Data VTR Data~~	~~.018, .064, .084, .089, .039~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 0, 1~~	~~0, 0, 0, 0, 0~~	~~3.9, 8.1, 7.5, 0, 4.9~~	~~3.9, 8.1, 7.5, 0, 4.9~~	~~.46, .38, .76, 0, .70~~	~~5 (.31)~~
~~Northeast Mid-Water Trawl - Including Pair Trawl[e]~~	~~03-07~~	~~28, 22, 25, 25, 7~~	~~Obs. Data Dealer Data VTR Data~~	~~.031, .126, .199, .031, .08~~	~~0, 0, 0, 0, 0~~	~~0, 1, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~1.9, 1.4, 1.1, 0, 0~~	~~unk, 1.9, 1.4, 1.1, 0, 0~~	~~.56, .58, .68, 0, 0~~	~~1 (.35)~~
~~Pelagic Longline (excluding NED-E)[f]~~	~~03-07~~	~~63, 60, 60, 63, 62~~	~~Obs. Data Logbook~~	~~.09, .09, .06, .07, .08~~	~~2, 6, 9, 12, 5~~	~~0, 0, 0, 1, 0~~	~~21, 74, 212, 169, 57~~	~~0, 0, 0, 16, 0~~	~~21, 74, 212, 185, 57~~	~~.77, .42, .21, .47, .65~~	~~110 (.20)~~
~~2005 Pelagic Longline experimental fishery[g]~~	~~05~~	~~6~~	~~Obs. Data~~	~~1~~	~~1~~	~~0~~	~~1~~	~~0~~	~~1~~	~~1.00~~	~~1(1.00)~~
~~TOTAL~~											~~166 (.14)~~

~~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).~~

~~c. 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.~~

~~d. . NE and MA bottom trawl mortality estimates reported for 2007 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2007 effort. Complete documentation of methods used to estimate cetacean bycatch mortality are described in 'Estimated Bycatch of Cetaceans in Northeast U.S. Bottom Trawl Fishing Gear' but is not available for distribution. The manuscript is expected to be published in early 2009. e. The data used to predict bycatch rates to estimate annual mortality were pooled over the years 2003-2006. The data are treated as one data set and assumed to represent average fishing practices during the time period. Regression techniques within a model framework were applied to the pooled data set. Therefore, if there was no observed bycatch reported for any one given year, this does not imply that there was no bycatch during that year. The exception would be if year was selected by the model as an important factor associated with observing bycatch.~~

~~f. An experimental program to test effects of gear characteristics, environmental factors, and fishing practices on marine turtle bycatch rates in the Northeast Distant (NED-E) water component of the fishery was conducted from June 1, 2001-December 31, 2003. Observer coverage was 100% during this experimental fishery. Summaries are provided for the pelagic longline EXCLUDING the NED-E area in one row and for ONLY the NED in the second row. No mortalities or serious injuries were observed for pilot whales in the NED-E, though 1 pilot whale was caught alive and released without injury (Garrison, 2003; Garrison and Richards, 2004).~~

~~g. 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 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]	04-08	Obs. Data Dealer	.03, .03, .02, .03, .03	0, 0, 0, 0, 0	0, 4, 1, 0, 0	0, 0, 0, 0, 0	35, 31, 37, 36, 24	35, 31, 37, 36, 24	.33, .31, .34, .38, .36	33 (.13)
Northeast Bottom Trawl[c]	04-08	Obs. Data Dealer Data VTR Data	.05, .12, .06, .06, .08	0, 0, 0, 0, 0	0, 2, 4, 1, 4, 5	0, 0, 0, 0, 0	15, 15, 14, 12, 10	15, 15, 14, 12, 10	.29, .30, .28, .35, .34	13 (.12)

Mid-Altlantic Mid-Water Trawl - Including Pair Trawl[d]	04-08	Obs. Data Dealer Data VTR Data	.064, .084, .089, .0439, .131	0, 0, 0, 0, 0	0, 0, 0, 1, 0	0, 0, 0, 0, 0	8.1, 7.5, 0, 0, 0, 11.212 4.9, 0	0, 0, 0, 11.212-, 08.1, 7.5, 0, 4.9, 0	.38, .76, 0, 0, 0,.71.020. 99, 0	42.24 (.141.020.99)
Northeast Mid-Water Trawl - Including Pair Trawl[d]	04-08	Obs. Data Dealer Data VTR Data	.1326, .20199, .031, .08, .208	0, 0, 0, 0, 0	1, 0, 0, 0, 63	0, 0, 0, 0, 0	1.4, 1.1, 0, 0, 6.55.3, 0, 0, 0, 13.116	5.3, 0, 0, 0, 13.1161.4, 1.1, 0, 0, 6.5	.58, .68, 0, 0, .560.982, 0, 0, 0, .601,	3.71.84.3 (.0751)
Pelagic Longline	04-08	Obs. Data Logbook	.09, .06, .07, .07, .07	6, 9, 12, 5, 5	0, 0, 1, 0, 0	74, 212, 169, 57, 98	0, 0, 16, 0, 0	74, 212, 185, 57, 98	.42, .21, .47, .65, .42	122 (.19)
2005 Pelagic Longline experimental fishery[e]	05	Obs. Data	1	1	0	1	0	1	1.00	1(1.00)
TOTAL										1756 (.14)

[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 Mmid-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 and 2008 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2007 and 2008 effort. Complete documentation of methods used to estimate cetacean bycatch mortality are described in Rossman (2009).

[d] Within each of the fisheries (Northeast and Mid-Atlantic), tThe paired and single trawl data were pooled. used to predict bycatch rates to estimate annual mortality were pooled over the years 2003-2006. The data are treated as one1 data set and assumed to represent average fishing practices during the time period. Ratio estimation methods were used within each fishery and year to estimate the total the annual bycatch. Regression techniques within a model framework were applied to the pooled data set. Therefore, if there was no observed bycatch reported for any one1 given year, this does not imply that there was no bycatch during that year. The exception would be if year was selected by the model as an important factor associated with observing bycatch.

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

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) 1993b, stranding databases maintained by NMFS NER, NEFSC and SEFSC). From 2004- to 2008, 44 short-finned pilot whales (*Globicephala macrorhynchus*), 68 long-finned pilot whales (*Globicephala melas melas*), and 11 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). From 2003 to 2007, 72 short-finned pilot whales (*Globicephala macrorhynchus*), 78 long-finned pilot whales (*Globicephala melas*), and 8 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 one1 mass stranding of 18 long-finned pilot whales (including one1 pregnant female) as part of a multi-species mass stranding in Barnstable County, Massachusetts, on 10 December 2005. This includes several mass strandings as follows: 57 long finned pilot whales mass stranded in 2002 in Dennis, Massachusetts, and 18 in Brewster, Massachusetts in 2005; 28 short-finned pilot whales stranded in Content Passage, Monroe County, Florida (Atlantic side) on 18 April 2003, and 31 short-finned pilot whales stranded on the Outer Banks of North Carolina on 15-16 January 2005. Two juvenile animals that live stranded in Chatham, Massachusetts in 1999 were rehabilitated, satellite tagged and released . Both

~~animals were released off eastern Long Island, New York and tracked for four months in the Gulf of Maine. Four of 6 animals from one live stranding event in Massachusetts in 2000 were rehabilitated and released. However, certain studies have shown that frequently, animals that are returned to the water swim away and strand someplace else~~ (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~~. 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 ~~(*Globicephala macrorhynchus*)~~ was involved in this UME.

A UME mass stranding of ~~thirty-three~~33 short-finned pilot whales, including 5~~five~~ 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),~~ though~~ but no single cause for the UME was determined. ~~Evidence is lacking to support a definitive association between this unusual mortality event and naval activity using mid-frequency active sonar in this spatial and temporal vicinity, though this does not preclude the possibility that this mass stranding was a behavioral avoidance to noise exposure associated with the naval activity. The definitive cause of this UME is not known.~~

Short-finned pilot whales strandings ~~(*Globicephala macrorhynchus*)~~ have been reported stranded as far north as Nova Scotia (1990) and Block Island, Rhode Island (2001), 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 long-finned pilot whale strandings were from North Carolina northward (Table 3).

~~Between~~During ~~2003 and~~2004~~–2007~~2008, several human and/or fishery interactions were documented in stranded pilot whales.~~ Two long-finned pilot whales stranded dead separately in April 2003 off New Jersey with rope tied around the flukes, and signs of human interaction were reported (but no specifics recorded in database) on 1 short-finned pilot whale which stranded in May 2003 in Florida.~~ During a UME in Dare, North Carolina, in January 2005, ~~six~~6 of the 33 short-finned pilot whales which mass stranded had fishery interaction marks (specifics not given) which 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, ~~one~~1 with a line on its flukes and another with human interactions noted but specifics not given. Of the 2006 stranding mortalities, ~~two~~2 were reported as exhibiting signs of human interaction, ~~one~~1 in Massachusetts and ~~one~~1 in Virginia. In 2008, ~~one~~1 Massachusetts stranding mortality was deemed a fishery interaction due to line markings and cut flukes. The ~~two~~2 New York strandings of long-finned pilot whales were classified as human interactions.

~~Table 3. Pilot whale (*Globicephala macrorhynchus* (SF), *Globicephala melas* (LF) *and Globicephala* sp. (Sp) strandings along the Atlantic coast, 2003-2007. Strandings which 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~~	~~2003~~			~~2004~~			~~2005~~			~~2006~~			~~2007~~			~~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~~	~~3~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~12~~
~~Maine~~	~~0~~	~~1~~	~~0~~	~~0~~	~~4~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1[b]~~	~~0~~	~~0~~	~~9~~	~~0~~
~~New Hampshire~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~

Massachusetts	0	5	0	0	1	0	0	22[m]	0	0	2	0	0	6[c]	0	0	36	0
Rhode Island	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0
Connecticut	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New York	0	0	0	0	3	0	0	1	0	0	0	0	0	2	0	0	6	0
New Jersey	0	6[d]	0	0	0	0	0	0	2	1	0	0	0	1	0	1	6	2
Delaware	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4	0
Virginia	0	3	0	0	0	1[e]	0	4[n]	0	0	2	0	0	0	0	0	9	1
North Carolina	2	0	1	1[f]	1	1[f]	35[k,l]	1	2	0	0	1	0	0	0	38	2	5
South Carolina	0	1[g]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1[g]	0
Georgia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	29[h,i]	0	0	4	0	0	0	0	0	0	0	0	0	0	0	33	0	0
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEZ	0	1[j]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0
TOTALS - U.S., Puerto Rico, & EEZ	31	18	1	5	10	2	35	35	4	1	6	1	0	10	0	72	78	8

a. Data supplied by Tonya Wimmer, Nova Scotia Marine Animal Response Society (pers. comm.).

b. Long-finned pilot whale stranded in Maine in 2007 released alive.

c. One of the strandings in 2007 classified as human interaction due to attempts to herd the animal to deeper water.

d. Two long-finned pilot whales stranded dead separately in April 2003 off New Jersey with rope tied around the flukes.

e. One pilot whale stranded in Virginia in 2004 during an Unusual Mortality Event but was not identified to species (decomposed and decapitated).

f. One short-finned pilot whale (September) and one 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 North Carolina in February, not related to any UME.

g. Only moderate confidence on species identification as long-finned pilot whale.

h. Includes mass live stranding of 28 short-finned pilot whales in Content Passage, Monroe County, FL (Ocean side) on 19 April 2003 – 12 animals died or were euthanized at the scene, 9 were returned to sea, 7 were taken into rehabilitation of which 2 subsequently died and 5 were released to sea on 10 August 2003.

i. Signs of human interaction reported on 1 stranded short-finned pilot whale (not part of the live mass stranding), which stranded in May 2003 in Florida.

j. One long-finned pilot whale floating dead on Georges Bank offshore.

k. 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.

l. Signs of fishery interaction observed on a short-finned pilot whale stranded in May in NC.

m. Includes 18 pilot whales which were part of a multi-species mass stranding in Brewster on 10 December 2005.

n. Sign of human interaction (a line on the flukes) observed on 2 animals, and one animal was a pregnant female.

Table 3. Pilot whale (*Globicephala macrorhynchus* ([SF]), *Globicephala melas melas* ([LF]) *and Globicephala* sp. ([Sp])) strandings along the Atlantic coast, 2004-2008. Strandings which 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	2004			2005			2006			2007			2008			TOTALS		
	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp

Nova Scotia[a]	0	0	3	0	0	2	0	0	3	0	0	2	0	0	0	0	0	10
Newfoundland and Labrador[b]	0	2	0	0	2	0	0	0	3	0	0	1	0	0	2	0	4	6
Maine[c]	0	4	0	0	2	0	0	1	0	0	1	0	0	1	1	0	9	1
New Hampshire	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
Massachusetts[d]	0	1	0	0	22	0	0	2	0	0	6	0	0	1	1	0	32	1
Rhode Island	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0
New York	0	3	0	0	1	0	0	0	0	0	2	0	0	2	0	0	8	0
New Jersey	0	0	0	0	0	2	1	0	0	0	1	0	0	1	0	1	2	2
Delaware	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0
Virginia[e]	0	0	1	0	4	0	0	2	0	0	0	0	0	0	0	0	6	1
North Carolina[f]	1	1	1	35	1	2	0	0	1	0	0	0	3	0	1	39	2	5
South Carolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Florida	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
EEZ	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
TOTALS - U.S., Puerto Rico, & EEZ	5	10	2	35	35	4	1	6	1	0	10	0	3	7	4	44	68	11

[a] Data supplied by Tonya Wimmer, Nova Scotia Marine Animal Response Society (pers. comm.).
[b] (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009).
[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.
[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.

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 mass live strandings occurred in Nova Scotia recently.~~ -~~ ~~14~~Fourteen pilot whales live mass stranded in 2000, ~~and~~ 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. ~~With the collapse of the squid stocks on the Grand Banks, pilot whale numbers in the area declined and there have been few or no strandings in recent years (Lawson, DFO, pers. comm.).~~

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	70	Pt. Leamington

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	October 25	18	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 species is not listed under the Endangered Species 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 ~~two~~2 species~~.~~. 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 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 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. t~~This should be considered a~~is not a~~ strategic stock~~ because the 2003~~2004 2007 2008 estimated average annual human-related mortality does not exceed PBR~~. However, the inability to partition mortality estimates between the species limits the ability to adequately assess the status of this stock.~~However, the continuing inability to distinguish between species of pilot whales, and the fact that PBR and abundance estimates are not available for the individual stocks, raises concerns about the possibility of mortalities of one stock or the other exceeding PBR.~~

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

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STOCK DEFINITION AND GEOGRAPHIC RANGE

~~The short-finned pilot whale is distributed worldwide in tropical to warm temperate waters .~~ There are 2~~two~~ species of pilot whales in the western North Atlantic - the ~~Atlantic or~~ long-finned pilot whale, *Globicephala melas*, and the short-finned pilot whale, *G. macrorhynchus*. These species are difficult to differentiate at sea; therefore, ~~much of the descriptive material below refers to *Globicephala* sp. and is identi~~the ability to separately assess the 2~~two~~ stocks in U.S. Atlantic waters is limited. ~~fied as such.~~ Sightings of ~~these~~ pilot whales (*Globicephala sp.*) ~~animals~~ in the ~~U.S. Atlantic EEZ~~western North Atlantic occur ~~in oceanic waters~~ primarily near the continental shelf break ranging from Florida to the Nova Scotian 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 (Payne and Heinemann 1993; Garrison *et al.*, in review). In addition, short-finned pilot whales are documented ~~and~~ 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. ~~. Information on stock differentiation for the Atlantic population based on morphological, genetic, and/or behavioral data is in progress.~~ Pending these results, the ~~western North Atlantic~~ *Globicephala* ~~sp~~ *macrorhynchus*~~.~~ ~~Population~~population occupying U.S. Atlantic waters~~(s)~~ is ~~provisionally being~~ considered ~~a~~ separate ~~stock~~ from both the northern Gulf of Mexico stock and short-finned pilot whales occupying Caribbean waters~~(s)~~.

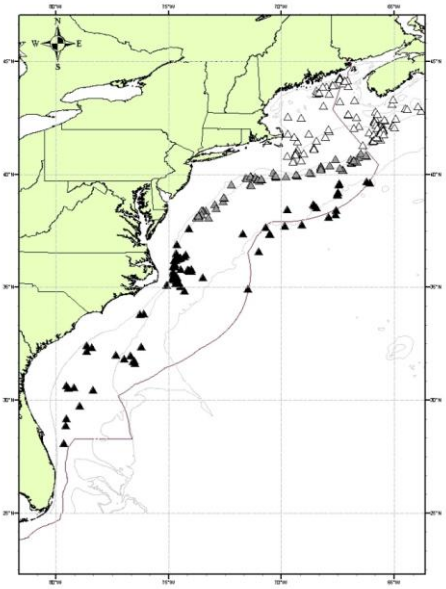

Figure 1. *Distribution of long-finned (open symbols), short-finned (black symbols), and possibly mixed (gray symbols) pilot whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006 and 2007. The inferred distribution of the two species is preliminary 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 total number of short-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. Because long-finned and short-finned pilot whales are difficult to distinguish at sea, sightings data are reported as *Globicephala sp*. ~~Sightings~~ ~~s~~Sightings ~~were~~ 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 ~~two~~2 species have previously been derived from line transect surveys. The best available abundance estimates are from surveys conducted during the summer of 2004 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 ~~two~~2 species based on genetic analyses of biopsy samples to derive separate abundance estimates (Garrison *et al.*, in ~~prep~~review). The resulting

abundance estimate for short-finned pilot whales is 24,674 (CV~~=~~ 0.45). ~~almost exclusively in the continental shelf edge and continental slope areas (Figure 1). Because long-finned and short-finned pilot whales are difficult to identify at sea, seasonal abundance estimates are reported for *Globicephala* sp., both long-finned and short-finned pilot whales. The best abundance estimate for *Globicephala* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys. This joint estimate (15,728 + 15,411 = 31,139 whales) is considered best because these two surveys together have the most complete coverage of the species' habitat.~~

Earlier Estimates

Please see appendix IV for earlier estimates and descriptions of abundance surveys. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable and should not be used for PBR determinations. 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 ~~which covered~~covering 7,465 ~~-~~km of trackline ~~over~~ in U.S. waters from the 1,000~~–~~-m depth contour on the southern edge of Georges Bank north to the Gulf of ~~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~~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~~s~~ 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 ~~two~~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 ~~M~~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 ~~15,411~~21,056 animals (CV ~~-~~=0.~~43~~54;~~)~~. Garrison *et al.*, in review).

An abundance estimate of 26,535 (CV=0.35) *Globicephala* sp. was obtained from an aerial survey conducted in August 2006 ~~which~~ 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; Palka pers. comm.).

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).

Table 1. Summary of abundance estimates for the western North Atlantic *Globicephala* sp. 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	~~15,411~~21,056	0.~~43~~54

Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	~~31,139~~36,784	0.~~27~~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

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 at water temperatures ~~less than~~< 22°C, the probability of a sample coming from a short-finned pilot whales was near ~~zero~~0, and at temperatures >25°C, this probability was near 1. 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 ~~two~~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 ~~a~~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 review~~,~~; Garrison *et al.*, in prep.).

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~~a~~ sp. macrorhynchus*~~.~~ is ~~31,139~~24,674 animals (CV=0.~~27~~45). ~~derived from the 2004 survey.~~ ~~s.~~ The minimum population estimate ~~for *Globicephala* sp.~~ is ~~24,866~~17,190.

Current Population Trend

There are insufficient data to determine population trends for *Globicephala ~~sp.~~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 ~~long~~short-finned pilot whales taken in ~~the Newfoundland drive fishery include~~fisheries off the Pacific coast of Japan. In this region, there are ~~two~~2 distinct stocks of short-finned pilot whales described as "northern" and "southern" types. There were demonstrable differences in the demographic parameters of these ~~two~~2 forms perhaps related to habitat differences (Kasuya and Tai~~,~~ 1993). The northern form w~~ere~~as 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 ~~3.3~~5.1 – 7.8 years; lactation period about ~~21-22~~2.0 - 2.78 years ~~months~~; gestation period ~~12~~ approximately 15 months; ~~births mainly from June to November;~~ length at birth ~~of~~ ~~177~~ 140 - 185 cm; mean length at sexual maturity of ~~490~~ 420 ~~–~~ 560 cm for males and ~~356~~ 316-400 cm for females; mean age at sexual maturity of ~~12~~ 17 years for males and ~~6~~ 8 - 9 years for females; ~~mean adult length of 557 cm for males and 448 cm for females;~~ and maximum age of ~~40~~ 45 for males and ~~50~~ 62 for females (Kasuya and

Tai 1993). ~~Analysis of data from animals taken in the Faroe Islands drive fishery for long-finned pilot whales produced higher values for all parameters . 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 ~~*Globicephala* sp.~~short-finned pilot whales is 17,190~~24,866~~. 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 ~~Globicephala sp.~~short-finned pilot whale~~s~~ is ~~249~~172.~~. It is not possible to determine the PBR for only short-finned pilot whales.~~

ANNUAL HUMAN-CAUSED MORTALITY

The total annual human caused mortality of short-finned pilot whales cannot be determined. The highest bycatch rates in the pelagic longline fishery area were observed during September – October along the mid-Atlantic coast (Garrison 2007). In bottom trawls, most mortalities were observed in the same area between July and November (Rossman 200~~6~~9). The model used to derive abundance estimates uses data restricted to the warmest months of the year (June-August), and there is currently very little data available for the potential area of overlap during the fall. ~~The majority of observed mortality and serious injury to pilot whales is observed during October-November along the mid-Atlantic coast (Garrison 2007;Rossman 2006). The habitat model described above is valid only for summer months, and t~~Therefore it is not possible to partition mortality estimates between the ~~two~~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 are thus presented only for the ~~two~~2 species combined. Total annual estimated average fishery-related mortality or serious injury ~~to this stock~~ during ~~2003~~2004-~~2007~~ 2008 was ~~166~~ 176 pilot whales (CV=0.14; 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.

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the ~~two~~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 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 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).

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 ~~one~~1 interaction, the net was pursed around ~~one~~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 ~~were~~ 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/~~M~~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 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/~~M~~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 included as a component of the mid-Atlantic bottom trawl fishery.

There was ~~one~~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 included as a component of the mid-Atlantic bottom 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).

Pelagic Longline

Most of the estimated marine mammal bycatch in the U.~~.~~S. Pela~~l~~gic Longline Fishery was ~~from~~ 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)~~-~~. Pilot whales are frequently observed to feed on hooked fish, particularly big-eye tuna (NMFS unpublished data). Between 1992 and ~~2006~~2008, ~~128~~ 154 pilot whales were observed released alive, including ~~73~~ 83 that were considered seriously injured, and 5 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)~~-~~. 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 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 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. 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), ~~and~~ 57 (CV=0.47) in 2007, and 98 (CV=0.42) in 2008. The average 'combined' annual mortality and serious injury in ~~2003~~2004-~~2007~~ 2008 was

122~~110~~ pilot whales (CV=0.~~20~~19) (Table 2).

An experimental fishery was conducted on 6~~six~~ vessels operating in the Gulf of Mexico and off the U.S. east coast in 2005, with 100% observer coverage achieved during this experimental fishery. 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 ~~one~~1 which was seriously injured (Fairfield Walsh and Garrison 2006).

Mid-Atlantic Bottom Trawl

Two pilot whales were observed taken in the ~~M~~mid-Atlantic bottom trawl in 2000, ~~four~~4 in 2005, ~~one~~1 in 2006, ~~and zero~~0 in 2007, and ~~zero~~0 in 2008. 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, ~~and~~ 37 (CV=0.38) in 2007, and 24 (CV=0.36) in 2008. The ~~2003~~2004-~~2007~~ 2008 average mortality attributed to the ~~M~~mid-Atlantic bottom trawl was ~~3~~34 animals (CV=0.~~15~~13).

Northeast Bottom Trawl

Two pilot whales were observed taken in the Northeast bottom trawl in 2004, ~~four~~4 in 2005, ~~one~~1 in 2006, ~~and four~~4 in 2007, and five in 2008. 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, ~~and~~ 12 (CV=0.35) in 2007, and 10 (CV=0.34) in 2008. The ~~2003~~2004-~~2007~~ 2008 average mortality attributed to the northeast bottom trawl was 15 animals (CV=0.13).

Northeast Mid-Water Trawl – Including Pair Trawl

In Sept 2004 a~~A~~ pilot whale was observed taken in the paired~~single~~ mid-water trawl fishery on the northern edge of Georges Bank (off ~~of~~ Massachusetts) in a haul that was targeting (and primarily caught) herring ~~in 2004~~. 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. 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 ~~bycatch rate model used the 2003 to September 2007 observed mid-water trawl data, including~~ paired and single~~, and~~ Northeast ~~and Mmid-Atlantic~~ mid-water trawls were pooled and only hauls that targeted herring and mackerel were used. The VTR herring and mackerel~~. The VTR~~ data were used to estimate the total effort (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.~~ Estimated annual fishery-related mortalities were: unknown in 2001-2002, ~~1.9 (CV=0.56)~~0 in 2003, and 5~~.~~.3~~6~~1.4 (CV=0.9~~8~~2~~58~~) in 2004, ~~1.1 (CV=0.68)~~0 in 2005 to~~, 0 in 2006,~~ ~~and 0 in~~ 2007~~-~~, and ~~6.5~~13.~~1~~16 (CV=0.6~~0~~1~~0.56~~) in 2008~~.~~ (Table 2; Palka pers. comm.). The average annual estimated mortality during 2004-2008 was ~~3.7~~1.~~8~~4.3 (CV=0.51~~07~~).~~(Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during 2003-2007 was 1 (CV=0.35).~~

~~A pilot whale was observed taken in the single trawl fishery on the northern edge of Georges Bank (off of Massachusetts) in a haul that was targeting (and primarily caught) herring in 2004. 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 Mmid-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. Estimated annual fishery-related mortalities were: unknown in 2001-2002, 1.9 (CV=0.56) in 2003, 1.4 (CV=0.58) in 2004, 1.1(CV=.68) in 2005, 0 in 2006, and 0 in 2007. (Table 2; Palka, pers. comm.). The average annual estimated fishery-related mortality during 2003-2007 was 1 (CV=0.35).~~

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

In March 2007 a~~No~~ pilot whales wase~~re~~ observed bycaught in the single mid-water~~is~~ fishery ~~between 2002 and 2006, or in 2008, though because of data pooling, estimates were still generated for some years~~ 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 and mackerel were used. The VTR herring and mackerel data were used to estimate the total effort~~the bycatch rate model used the 2003 to September 2006 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.~~ Estimated annual fishery-related mortalities were unknown in 2002, 0 in~~3.9 (CV=0.46) in~~ 2003 ~~, 8.1 (CV=0.38) in 2004, 7.5 (CV=0.76) in 2005, 0 in~~ to 2006, ~~and~~ ~~11.24.9~~12.1 (CV=~~0.70~~1.~~02~~0.99) in 2007-, and 0 in 2008 (Table 2; Palka pers. com.). The average annual estimated mortality during 2004-2008 was 2.~~2~~4~~4~~ (CV=~~0.1.02~~0.99~~4~~).~~(Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during 2003-2007 was 5 (CV=0.31).~~

~~No pilot whales were observed bycaught in this fishery between 2002 and 2006, though because of data pooling, estimates were still generated. 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. Estimated annual fishery-related mortalities were unknown in 2001-2002, 3.9 (CV=0.46) in 2003, 8.1 (CV=0.38) in 2004, 7.5 (CV=.76) in 2005, 0 in 2006, and 4.9 (CV=0.70) in 2007 (Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during 2003-2007 was 5 (CV=0.31).~~

CANADA

An unknown number 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 were 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 ~~one~~1 record of incidental catch in the offshore Greenland halibut fishery that involved ~~one~~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 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 ~~b~~a	Observer ~~Coverage~~ c Coverage b	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality

Mid-Atlantic Bottom ~~Trawl[a]~~Trawl[c]	~~03~~04-~~07~~08	Obs. Data Dealer	~~.01,~~ .03, .03, .02, .03, .03	0, 0, 0, 0, 0	~~0,~~ 0, 4, 1, 0, 0	0, 0, 0, 0, 0	~~31,~~ 35, 31, 37, 36, 24	~~31,~~ 35, 31, 37, 36, 24	~~.31,~~ .33, .31, .34, .38, .36	~~34~~ 33 (~~.15~~13)
Northeast Bottom ~~Trawl[a]~~ Trawl[c]	~~03~~04-~~07~~08	Obs. Data Dealer Data VTR Data	~~04,~~ .05, .12, .06, .06, .08	0, 0, 0, 0, 0	~~0,~~ 0, 2, 4, 1, 4, 5	0, 0, 0, 0, 0	~~20,~~ 15, 15, 14, 12, 10	~~20,~~ 15, 15, 14, 12, 10	~~.26,~~ .29, .30, .28, .35, .34	~~15~~ 13 (~~.13~~12)
Mid-Altlantic Mid-Water Trawl - Including Pair ~~Trawl[e]~~Trawl[d]	~~03~~04-~~07~~08	Obs. Data Dealer Data VTR Data	.06, .08, .09, .04, .13~~,018, .064, .084, .089, .039~~	0, 0, 0, 0, 0~~0, 0, 0, 0, 0~~	0, 0, 0, 1, 0~~0, 0, 0, 1~~	0, 0, 0, 0, 0~~0, 0, 0, 0, 0~~	0, 0, 0, ~~11.2~~ 12, 0~~3.9, 8.1, 7.5, 0, 4.9~~	0, 0, 0, ~~11.2~~12, .0~~3.9, 8.1, 7.5, 0, 4.9~~	.0, 0, 0,~~1.02~~0 .99, 0~~.46, .38, .76, 0, .70~~	2,24 (~~1.02~~0.99)~~5 (.31)~~
Northeast Mid-Water Trawl - Including Pair Trawl ~~[e]~~[d]	~~03~~04-~~07~~08	Obs. Data Dealer Data VTR Data	.13, .20, .03, .08, .20~~.031, .126, .199, .031, .08~~	0, 0, 0, 0, 0~~0, 0, 0, 0, 0~~	1, 0, 0, 0, 6~~0, 1, 0, 0, 0~~	0, 0, 0, 0, 0~~0, 0, 0, 0, 0~~	5.3, 0, 0, 0, ~~13.1~~16~~1.9, 1.4, 1.1, 0, 0~~	5.3, 0, 0, 0, ~~13.1~~16~~1.9, 1.4, 1.1, 0, 0~~	0.9~~8~~2, 0, 0, 0, .6~~0~~1, ~~.5 6, .58, .68, 0, 0~~	~~3.7~~4.3 (.51)~~1 (.35)~~
Pelagic Longline ~~(excluding NED-E)[f]~~	~~03~~04-~~07~~08	Obs. Data Logbook	~~.09,~~ .09, .06, .07, .~~08~~07, ~~22~~.07	~~2,~~ 6, 9, 12, 5, 5	~~0,~~ 0, 0, 1, 0, 0	~~21,~~ 74, 212, 169, 57, 98	~~0,~~ 0, 0, 16, 0, 0	~~21,~~ 74, 212, 185, 57, 98	~~.77,~~ .42, .21, .47, .65, .42	~~110~~122 (.~~20~~19)
2005 Pelagic Longline experimental ~~fishery[g]~~fishery[e]	05	Obs. Data	1	1	0	1	0	1	1.00	1(1.00)
TOTAL										~~166~~ 175~~6~~ (.14)

~~[a] . Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.~~

[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 ~~M~~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 and 2008 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2007 and 2008 effort. Complete documentation of methods used to estimate cetacean bycatch mortality are described in ~~'Estimated Bycatch of Cetaceans in Northeast U.S. Bottom Trawl Fishing Gear' but is not available for distribution. The manuscript is expected to be published in early 2009~~Rossman (2009).

[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.

~~f. An experimental program to test effects of gear characteristics, environmental factors, and fishing practices on marine turtle bycatch rates in the Northeast Distant (NED-E) water component of the fishery was conducted from June 1, 2001-December 31, 2003. Observer coverage was 100% during this experimental fishery. Summaries are provided for the pelagic longline EXCLUDING the NED-E area in one row and for ONLY the NED in the second row. No mortalities or serious injuries were observed for pilot whales in the NED-E, though 1 pilot whale was caught alive and released without injury (Garrison, 2003; Garrison and Richards, 2004).~~

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

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)~~(NMFS 1993, stranding databases maintained by NMFS NER, NEFSC and SEFSC)~~. From ~~2003~~2004-

~~2007~~2008, ~~72~~ 44 short-finned pilot whales (*Globicephala macrorhynchus*) ~~(*Globicephala macrorhynchus*)~~, ~~78~~ 68 long-finned pilot whales (*Globicephala melas melas*), and ~~8~~ 11 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 ~~several one~~1 mass strandin~~gs as follows: 57 long-finned pilot whales stranded in 2002 in Dennis, Massachusetts; 28 short-finned pilot whales stranded in Content Passage, Monroe County, Florida (Atlantic side) on 18 April 2003; and~~ g of 18 long-finned pilot whales (including ~~one~~1 pregnant female) as part of a multi-species mass stranding in Barnstable County, Massachusetts, on 10 December 2005. ~~Two juvenile animals that live stranded in Chatham, Massachusetts in 1999 were rehabilitated, satellite tagged and released (Nawojchik *et al.* 2003). Both animals were released off eastern Long Island, New York and tracked for four months in the Gulf of Maine. Four of 6 animals from one live stranding event in Massachusetts in 2000 were rehabilitated and released. However, certain studies have shown that frequently animals that are returned to the water swim away and strand someplace else (Fehring and Wells 1976; Irvine *et al.* 1979; Odell *et al.* 1980). The fate of the animals, when known, is footnoted in Table 3.~~

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 ~~(*Globicephala macrorhynchus*)~~ was involved in this UME.

A UME mass stranding of 33~~thirty-three~~ short-finned pilot whales, including ~~five~~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)~~(Hohn *et al.* 2006)~~, ~~though~~ but no single cause for the UME was determined.

~~Evidence is lacking to support a definitive association between this unusual mortality event and naval activity using mid-frequency active sonar in this spatial and temporal vicinity, though this does not preclude the possibility that this mass stranding was a behavioral avoidance to noise exposure associated with the naval activity. The definitive cause of this UME is not known.~~

~~Table 3. Pilot whale (*Globicephala macrorhynchus* (SF), *Globicephala melas* (LF) *and Globicephala* sp. (Sp) strandings along the Atlantic coast, 2003-2007. Strandings which 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~~	~~2003~~			~~2004~~			~~2005~~			~~2006~~			~~2007~~			~~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~~	~~3~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~12~~
~~Maine~~	~~0~~	~~1~~	~~0~~	~~0~~	~~4~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1[b]~~	~~0~~	~~0~~	~~9~~	~~0~~
~~New Hampshire~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~
~~Massachusetts~~	~~0~~	~~5~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~22[m]~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~6[c]~~	~~0~~	~~0~~	~~36~~	~~0~~
~~Rhode Island~~	~~0~~	~~1~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~
~~Connecticut~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~New York~~	~~0~~	~~0~~	~~0~~	~~0~~	~~3~~	~~0~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~6~~	~~0~~
~~New Jersey~~	~~0~~	~~6[d]~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~2~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~	~~0~~	~~1~~	~~6~~	~~2~~
~~Delaware~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Maryland~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~4~~	~~0~~
~~Virginia~~	~~0~~	~~3~~	~~0~~	~~0~~	~~0~~	~~1[e]~~	~~0~~	~~4[n]~~	~~0~~	~~0~~	~~2~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~9~~	~~1~~

North Carolina	2	0	1	1[f]	1	1[f]	35[kl]	1	2	0	0	1	0	0	0	38	2	5
South Carolina	0	1[g]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1[g]	0
Georgia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	29[hi]	0	0	4	0	0	0	0	0	0	0	0	0	0	0	33	0	0
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EEZ	0	1[j]	0	0	0	0	0	1	0	0	0	0	0	0	0	0	2	0
TOTALS - U.S., Puerto Rico, & EEZ	31	18	1	5	10	2	35	35	4	1	6	1	0	10	0	72	78	8

a. Data supplied by Tonya Wimmer, Nova Scotia Marine Animal Response Society (pers. comm.).
b. Long-finned pilot whale stranded in Maine in 2007 released alive.
c. One of the strandings in 2007 classified as human interaction due to attempts to herd the animal to deeper water.
d. Two long-finned pilot whales stranded dead separately in April 2003 off New Jersey with rope tied around the flukes.
e. One pilot whale stranded in Virginia in 2004 during an Unusual Mortality Event but was not identified to species (decomposed and decapitated).
f. One short-finned pilot whale (September) and one 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 North Carolina in February, not related to any UME.
g. Only moderate confidence on species identification as long-finned pilot whale.
h. Includes mass live stranding of 28 short-finned pilot whales in Content Passage, Monroe County, FL (Ocean side) on 19 April 2003 - 12 animals died or were euthanized at the scene, 9 were returned to sea, 7 were taken into rehabilitation of which 2 subsequently died and 5 were released to sea on 10 August 2003.
i. Signs of human interaction reported on 1 stranded short-finned pilot whale (not part of the live mass stranding), which stranded in May 2003 in Florida.
j. One long-finned pilot whale floating dead on Georges Bank offshore.
k. 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.
l. Signs of fishery interaction observed on a short-finned pilot whale stranded in May in NC.
m. Includes 18 pilot whales which were part of a multi-species mass stranding in Brewster on 10 December 2005.
n. Sign of human interaction (a line on the flukes) observed on 2 animals, and one animal was a pregnant female.

Table 3. Pilot whale (*Globicephala macrorhynchus* ([SF)], *Globicephala melas_melas* ([LF)] *and Globicephala* sp. ([Sp)]) strandings along the Atlantic coast, 2004-2008. Strandings which 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	2004			2005			2006			2007			2008			TOTALS		
	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp	SF	LF	Sp
Nova Scotia[a]	0	0	3	0	0	2	0	0	3	0	0	2	0	0	0	0	0	10
Newfoundland and Labrador[b]	0	2	0	0	2	0	0	0	3	0	0	1	0	0	2	0	4	6
Maine[c]	0	4	0	0	2	0	0	1	0	0	1	0	0	1	1	0	9	1
New Hampshire	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
Massachusetts[d]	0	1	0	0	22	0	0	2	0	0	6	0	0	1	1	0	32	1
Rhode Island	0	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0
New York	0	3	0	0	1	0	0	0	0	0	2	0	0	2	0	0	8	0

New Jersey	0	0	0	0	0	2	1	0	0	0	1	0	0	1	0	1	2	2
Delaware	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	4	0
Virginia[e]	0	0	1	0	4	0	0	2	0	0	0	0	0	0	0	0	6	1
North Carolina[f]	1	1	1	35	1	2	0	0	1	0	0	0	3	0	1	39	2	5
South Carolina	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
Florida	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
EEZ	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
TOTALS - U.S., Puerto Rico, & EEZ	5	10	2	35	35	4	1	6	1	0	10	0	3	7	4	44	68	11

[a] Data supplied by Tonya Wimmer, Nova Scotia Marine Animal Response Society (pers. comm.).
[b] (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009).
[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.
[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 ~~one~~1 animal was a pregnant female.
[f] In 2004, ~~one~~1 short-finned pilot whale (September) and ~~one~~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.

Short-finned pilot whales strandings (*Globicephala macrorhynchus*) have been reported as far north as Nova Scotia (1990) and Block Island, Rhode Island (2001), 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 long-finned pilot whale strandings were from North Carolina northward (Table 3). ~~Between~~During ~~2003~~2004-~~2007~~2008, several human and/or fishery interactions were documented in stranded pilot whales. ~~Two long-finned pilot whales stranded dead separately in April 2003 off New Jersey with rope tied around the flukes, and signs of human interaction reported (but no specifics recorded in database) on 1 short-finned pilot whale which stranded in May 2003 in Florida.~~ During a UME in Dare, North Carolina, in January 2005, ~~six~~6 of the 33 short-finned pilot whales which mass stranded had fishery interaction marks (specifics not given) which 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, one with a line on its flukes and another with human interactions noted but specifics not given. Of the 2006 stranding mortalities, two were reported as exhibiting signs of human interaction, one in Massachusetts and one in Virginia. In 2007, signs of human interaction were reported for one long-finned pilot whale stranded in Massachusetts, after an unsuccessful attempt was made to herd the animal to deeper water. In 2008, one Massachusetts stranding mortality was deemed a fishery interaction due to line markings and cut flukes. The two New York strandings of long-finned pilot whales were classified as human interactions.~~

~~In eastern Canada, 37 strandings of long-finned pilot whales (173 individuals) were reported on Sable Island, Nova Scotia from 1970 to 1998 . 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 . Several mass live strandings occurred in Nova Scotia recently - 14 pilot whales live mass stranded in 2000 and 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). With the collapse of the squid stocks on the Grand Banks, pilot whale numbers in the area declined and there have been few or no strandings in recent years (Lawson, DFO, pers. comm.).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 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 species is not listed under the Endangered Species Act. The total U.S. fishery-related mortality and serious injury for *Globicephala* sp.short-finned pilot whales is unknown, since it is not possible to partition mortality estimates between the two2 species. 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 is unlikely to exceed PBR, since some portion of the mortality impacts long-finned pilot whales, and therefore tThis is not a strategic stock because the 2003-2007 estimated average annual human related mortality does not exceed PBR.. However, the continuing inability to distinguish between species of pilot whales, and the fact that PBR and abundance estimates are not available for the individual stocks, raises concerns about the possibility of mortalities of one stock or the other exceeding PBR. the inability to partition mortality estimates between the species limits the ability to adequately assess the status of this stock.

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~~1 January~~March 2010~~September 2009~~

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. ~~The~~ 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 ~~43~~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, and was obvious during abundance surveys conducted in the summers of 1995 and 1999 which covered waters from Virginia to the Gulf of St. Lawrence and during the Canadian component of the 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 few sightings were recorded between these two regions.

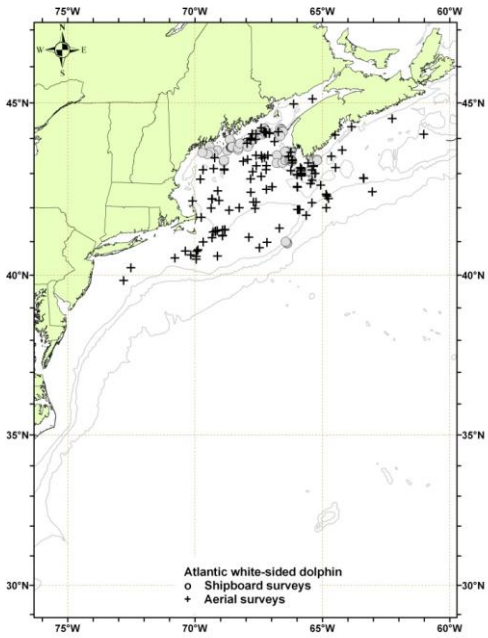

Figure 1. *Distribution of white-sided dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004,2006 and 2007. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

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. Sightings 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 and 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.

~~Prior to the 1970s, white-sided dolphins in U.S. waters were found primarily offshore on the continental slope, while white-beaked dolphins (*L. albirostris*) were found on the continental shelf. During the 1970s, there was an apparent switch in habitat use between these two species. This shift may have been a result of the decrease in herring and increase in sand lance in the continental shelf waters (Katona *et al.* 1993; Kenney *et al.* 1996).~~ Recent stomach content analysis of both stranded and incidental caught white-sided dolphins in U.S. waters, determined the most

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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 *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

The total number of white-sided dolphins along the eastern U.S. and Canadian Atlantic coast is unknown, although eight estimates from select regions are available from: 1) spring, summer and autumn 1978-1982; 2) July-September 1991-1992; 3) June-July 1993; 4) July-September 1995; 5) July-August 1999; 6) August 2002; 7) June-July 2004; and 8) August 2006. The best available current abundance estimate for white-sided dolphins in the western North Atlantic stock is 63,368 (CV=0.27), an average of the surveys conducted in August within the last 8 years (2002 and 2006). An average is used to account for the large inter-annual variability of the abundance estimates for this species. This variability may be associated with the water temperature and prey patterns.

An abundance estimate of 109,141 (CV=0.30) white-sided dolphins was obtained from an aerial survey conducted in July and August 2002 which covered 7,465 km of trackline over waters from the ~~1000~~ 1000-m depth contour on the southern edge of Georges Bank to Maine (Table 1). The value of g(0) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial surveys ~~data~~.

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 100m 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 ~~two~~ two-~~independent~~ independent-team ~~line~~ 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- 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 data of 2002, 2004 and 2006 aerial survey ~~datas~~.

An abundance estimate of 17,594 (CV=0.30) white-sided 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. 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). The value of g(0) was derived from the pooled data of 2002, 2004 and 2006 aerial survey ~~datas~~ (Table 1; Palka pers. comm.).

An abundance estimate of 5,796 (95%CI=2,681-13,088) white-sided dolphins was generated from the Canadian ~~Trans~~ Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007. This aerial survey covered 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).

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.

Table 1. Summary of recent abundance estimates for western North Atlantic stock of white-sided 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
Aug 2002	S. Gulf of Maine to Maine	109,141	0.30
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~~y~~-Aug 2007	N. Labrador to Scotian Shelf	5,796	0.43

2002 and 2006	Average of abundance estimates from 2 August surveys	63,368	0.27

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 63,368 (CV=0.27). The minimum population estimate for these white-sided dolphins is 50,883.

Current Population Trend

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 50,883. 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 (Wade and Angliss 1997). PBR for the western North Atlantic stock of white-sided dolphin is 509.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during ~~2003~~2004-~~2007~~ 2008 was ~~328~~ 266~~301~~ (CV=0.~~09~~13) white-sided dolphins (Table 2).

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 includes 9 documented takes by U.S. vessels involved in joint-venture (JV) fishing operations in which U.S. captains transfer 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. ~~joint venture (~~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 2 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-~~2007~~2008.

U.S.

Northeast Sink Gillnet

This fishery occurs year round from in ~~the~~ Gulf of Maine, Georges Bank and ~~in~~ southern New England waters. Between 1990 and 2007 there were ~~56~~ 60 white-sided dolphin mortalities observed in the Northeast sink gillnet fishery. Most were taken in waters south of Cape Ann during April to December. In recent years, the majority of the takes have been east and south of Cape Cod. During 2002, one of the takes was off Maine in the fall Mid-coast Closure Area in a pingered net. Estimated annual fishery-related mortalities (CV in parentheses) 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, 41 (0.71) in 2006, ~~and~~ 0 in 2007, and 8~~2~~1 (0.5~~6~~7) in 2008. Average annual estimated fishery-related mortality during ~~2003~~2004-~~2007~~ 2008 was ~~35~~ 38 white-sided dolphins per year (0.~~37~~~~41~~33; Table 2).

Northeast Bottom Trawl

Fifty mortalities were documented between 1991 and 2007 in the Northeast bottom trawl fishery; 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, 4 in 2006 and 1 in 2007. 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, 164 (0.34) in 2006, ~~and~~ 147 (0.35) in 2007, and 147 (0.32) in 2008. The ~~2003~~2004-~~2007~~ 2008 average mortality attributed to the ~~northeast~~ Northeast bottom trawl was ~~188~~ 174 animals (0.12; Table 2).

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

In July 2003 a~~A~~ white-sided dolphin was observed taken in the single trawl fishery on the northern edge of Georges Bank (off ~~of~~ Massachusetts) ~~during July 2003~~ in a haul that was targeting (and primarily caught) herring. ~~I, and~~ n September 2005 three~~3~~ white-sided dolphins were observed taken ~~in 2005 i~~in paired trawls targeting herring that were located near Jefferys Bank (off Maine). 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 Northeast 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~~Due to small sample sizes, the bycatch rate model used the 2003 to September 2007 observed mid-water trawl data from paired and single 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.~~ Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001-2002, 2~~2~~4 (0.97~~56~~) in 2003, ~~19 (0.58)~~0 in 2004, ~~15~~9.4 (~~0.31~~1.03) in 2005, and 0~~19 (0.44) in~~ in 2006 to~~, and 0 in 2007, and 5.6 (0.52) in~~ 2008 (Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during ~~2003~~2004-~~2007~~ 2007 was 15 (0.26; Table 2).

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

In February 2004 a~~A~~ white-sided dolphin was observed taken in the pair trawl fishery near Hudson Canyon (off New Jersey) ~~during February 2004~~ in a haul that was targeting mackerel. In March 2005 f~~F~~ive white-sided dolphins were observed taken in paired trawls targeting mackerel that were off Virginia. ~~in 2005~~. In February 2006, ~~and~~ three animals were observed taken ~~in 2006~~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. 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~~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.~~ Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001-2002, 0~~51 (0.46)~~ in 2003, ~~10~~522 (0.~~38~~99) in 2004, ~~97~~58 (~~0.36~~1.02) in 2005, ~~54~~29 (0.~~5~~74) in 2006, ~~and 3.2~~12 (0.~~70~~98) in 2007, and ~~3.7~~15 (0.743) in 2008 (Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during ~~2003~~2004-~~2007~~ 2008 was ~~62~~27 (0.~~21~~50; 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, one take was observed in 2005 and 2 in 2007. 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 (0.25) in 2006, ~~and~~ 21 (0.24) in 2007, and 16 (0.18) in 2008. The ~~2003~~2004-~~2007~~ 2008 average mortality attributed to the mid-Atlantic bottom trawl was ~~28~~ 25 animals (0.~~11~~10; Table 2).

Table 2. Summary of the incidental mortality of white-sided dolphins (*Lagenorhynchus acutus*) 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 Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet[d]	~~03~~04-~~07~~08	Obs. Data Weighout Trip Logbook	~~.03,~~ .06, .07, .04, .07, .05	~~1,~~ 1, 5, 2, 0, 4	~~31,~~ 7, 59 , 41, 0, 821	~~.93,~~ .98, .49 , .71, 0, .567	~~35~~ 38 (0.~~37~~4133)
Northeast Bottom Trawl[c]	~~03~~04-~~07~~08	Obs. Data Weighout	~~.04,~~ .05, .12, .06, .06, .08	~~12,~~ 16, 47, 4, 1, 3	~~216,~~ 200, 213, 164, 147, 147	~~.27,~~ .30, .28, .34, .35, .32	~~188~~ 174 (0.12)
Northeast Mid-water Trawl - Including Pair Trawl	~~03~~04-~~07~~08	Obs. Data Weighout Trip Logbook	~~.031,~~ .126, .199, .031, .08, .199	~~1,~~ 0, 3, 0, 0, 0	~~24, 19, 15, 19, 0, 5.60, 0, 9.4, 0, 0~~	~~.56, .58, .31, .44, 0, .520, 0, 1.03, 0, 0~~	~~15~~1.92 (1.03~~(0.2618)~~)
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	~~03~~04-~~07~~08	Obs. Data Weighout Trip Logbook	~~.018,~~ .064, .084, .089, .039, .133	~~0,~~ 1, 5, 3, 1, 32	~~51, 105, 97, 54, 3.2, 3.722, 58, 29, 12, 15~~	~~.46, .38, .36, .57, .70, .43~~.99, 1.02, .74, .98, .73	~~62~~2752 (0.~~21~~5016)
Mid-Atlantic Bottom Trawl[c]	~~03~~04-~~07~~08	Obs. Data Weighout Trip Logbook	~~.01,~~ .03, .03, .02, .03, .03	~~0,~~ 0, 1, 0, 2, 0	~~31,~~ 26, 38, 26, 21, 16	~~.25,~~ .20, .29, .25, .24, .18	~~28~~ 25 (.~~11~~10)
Total							~~32~~8266~~301~~ (0.~~09~~13)

a Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Observer Program. NEFSC collects 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 fishery and in the two mid-water trawl fisheries. In addition, the Trip Logbooks are the primary source of the measure of total effort (soak duration) in the mid-water and bottom trawl fisheries.

b Observer coverages for the Northeast sink gillnet are ratios based on metric tons of fish landed. Observer coverages of the trawl fisheries are ratios based on trips.

c A new method was used to develop preliminary estimates of mortality for the mid-Atlantic and Northeast trawl fisheries during 2003-2007. They are a product of bycatch rates predicted by covariates in a model framework and effort reported by commercial fishermen on mandatory vessel logbooks. This method differs from the previous method used to estimate mortality in these fisheries prior to 2000. Therefore, the estimates reported prior to 2000 can not be compared to estimates from 2003 and afterwards. NE and MA bottom trawl mortality estimates reported for 2008 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2008 effort (Rossman 2009).~~(Rossman 2010).~~

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.

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 1960's 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 ~~2003~~2004-~~2007~~ 2008 there were ~~288~~ 264 documented Atlantic white-sided dolphin strandings on the US Atlantic coast (Table 3). Twenty-~~seven~~ nine of these animals were released alive. Human interaction was indicated in ~~8~~ 10 records during this period. Of these, ~~4~~ 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. 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 taken 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, 1 was found in Minas Basin, 2 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 ~~2007~~ 2008 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, ~~and~~ 8-10 in 2007 (all but 3 released alive), and 3 (one released alive) in 2008 (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) and 2 in 2008 (one released alive and one dead) (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009).

~~Table 3. White-sided dolphin (*Lagenorhynchus acutus*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2003~~2004~~-2008~~7.

~~Area~~	~~-~~				~~-~~	~~**Total**~~
	~~2003~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	
~~Maine~~	~~2~~	~~10~~	~~3~~	~~3~~	~~1~~	~~19~~
~~New Hampshire~~	~~-~~	~~-~~	~~1~~	~~-~~	~~-~~	~~1~~
~~Massachusetts[a,b]~~	~~59~~	~~34~~	~~60~~	~~49~~	~~18~~	~~220~~
~~Rhode Island~~	~~-~~	~~-~~	~~2~~	~~4~~	~~-~~	~~6~~
~~Connecticut~~	~~1~~	~~-~~	~~-~~	~~-~~	~~-~~	~~1~~
~~New York[c]~~	~~2~~	~~1~~	~~-~~	~~3~~	~~5~~	~~11~~
~~New Jersey~~	~~1~~	~~1~~	~~6~~	~~1~~	~~-~~	~~9~~
~~Delaware~~	~~-~~	~~-~~	~~-~~	~~1~~	~~-~~	~~1~~
~~Maryland[b]~~	~~-~~	~~-~~	~~1~~	~~1~~	~~-~~	~~2~~
~~Virginia[b]~~	~~-~~	~~4~~	~~3~~	~~3~~	~~-~~	~~10~~
~~North Carolina~~	~~1~~	~~2~~	~~3~~	~~1~~	~~1~~	~~8~~
~~**TOTAL US**~~	~~**66**~~	~~**52**~~	~~**79**~~	~~**66**~~	~~**25**~~	~~288~~
~~Nova Scotia~~	~~-~~	~~2~~	~~-~~	~~1~~	~~9~~	~~12~~
~~GRAND TOTAL~~	~~66~~	~~54~~	~~79~~	~~67~~	~~34~~	~~300~~

~~[a] Records of mass strandings in Massachusetts during this period are: January 2003 - 4 animals; April 2003 - 28 animals; November 2003 - 4 animals; February 2005 - 8 animals (3 released alive); April 2005 - 6 animals (all released alive); May 2005 strandings of 2 animals (both released alive but one died later); 3 animals (one released alive) and 5 animals; December 2005 - 2 animals; and January 2006 4 separate events involving 23 white-sided dolphins (5 released alive); February 2006 2 events involving 1 and 5 animals; and July 2006 - 9 animals (7 released alive); January 2007 - 9 animals (3 released alive); and September 2007 - 3 animals.~~

[b] Strandings that appear to involve a human interaction are: 1 animal from Massachusetts in 2004 was a fishery interaction; and 1 other animal from Massachusetts in 2004 was found with twine obstructing its esophagus. In 2005, 5 animals had signs of human interaction (in Massachusetts, Maryland and Virginia) but in no case was the human interaction able to be determined to be the cause of death. In 2006, 1 animal from Massachusetts was classified as having signs of fishery interaction.

[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, 2004-2008.

Area						**Total**
	2004	2005	2006	2007	2008	
Maine	10	3	3	1	1	18
New Hampshire	-	1	-	-	-	1
Massachusetts[a,b]	34	60	49	18	33	194
Rhode Island	-	2	4	-	-	6
Connecticut	-	-	-	-	1	1
New York[c]	1	-	3	5	1	10
New Jersey	1	6	1	-	-	8
Delaware	-	-	1	-	-	1
Maryland	-	1	1	-	1	3
Virginia[b]	4	3	3	-	1	11
North Carolina	2	3	1	1	3	10
South Carolina	-	-	-	-	1	1
TOTAL US	**52**	**79**	**66**	**25**	**42**	**264**
Nova Scotia	2	-	1	9	3	15
Newfoundland and Labrador	1	1	3	1	2	8
GRAND TOTAL	55	80	70	35	47	287

[a] Records of mass strandings in Massachusetts during this period are: February 2005 - 8 animals (3 released alive); April 2005 - 6 animals (all released alive); May 2005 strandings of 2 animals (both released alive but one died later); 3 animals (one released alive) and 5 animals; December 2005 - 2 animals; 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).

[b] Strandings that appear to involve a human interaction are: 1 animal from Massachusetts in 2004 was a fishery interaction; and 1 other animal from Massachusetts in 2004 was found with twine obstructing its esophagus. In 2005, 5 animals had signs of human interaction but in no case was the human interaction able to be determined to

be the cause of death. 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.
[c] Records of mass strandings in New York during this period are: September 2007 - 3 animals.

STATUS OF STOCK

The status of white-sided 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. A trend analysis has not been conducted for this species. 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. This is a non-strategic stock because the ~~2003~~2004-~~2007~~ 2008 estimated average annual human related mortality does not exceed PBR.

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SHORT-BEAKED COMMON DOLPHIN (*Delphinus 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~~, tropical,~~ and subtropical seas. In the North Atlantic, common dolphins occur over the continental shelf along the ~~200~~100-2000-m isobaths and over prominent underwater topography and east as to the mid-Atlantic Ridge (29˚W) (Doksaeter *et al.* 2008; Waring *et al.* 2008) ~~from 50º N to 40º S latitude (Evans 1994)~~. 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). ~~eastern Florida (Gaskin 1992).~~ In waters off the northeastern USA coast common dolphins are distributed along the continental slope ~~(100 to 2,000 m)~~ 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 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 are occasionally found in the Gulf of Maine (Selzer and Payne 1988). 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).

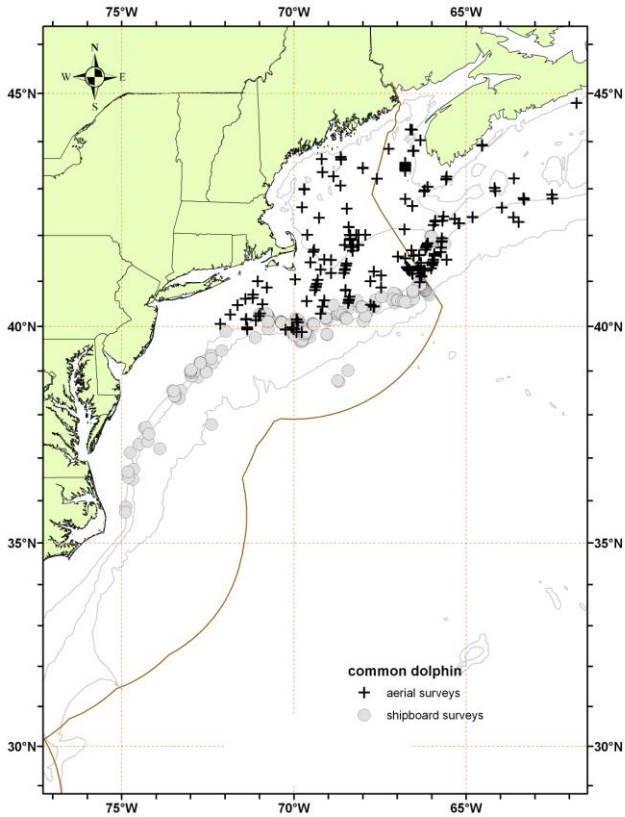

Figure 1. *Distribution of common dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006 and 2007. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

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 then 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 also a peak in parturition during July and August with an average birth day of July 28th. 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

The total number of common dolphins off the U.S. or Canadian Atlantic coast is unknown, although several abundance estimates are available from selected regions for selected time periods. The best abundance estimate for common dolphins is 120,743 animals (CV = 0.23). This is the sum of the estimates from two 2004 U.S. Atlantic surveys, where the estimate from the northern U.S. Atlantic is 90,547 (CV= 0.24), and from the southern U.S. Atlantic is 30,196 (CV =0.54). This joint estimate is considered best because these two surveys have the most complete coverage of the species' habitat (Table 1).

An abundance estimate of 6,460 (CV=0.74) common dolphins was obtained from an aerial survey conducted in July and August 2002 which 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) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.

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~~ 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- 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 > 50m) 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 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; 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~~ 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 53,625 (95%CI=35,179-81,773) common dolphins was generated ~~form~~ from the Canadian Trans North Atlantic Sighting Survey (TNASS)~~Canadian TNASS~~ ~~aerial survey~~ in July-August 2007. This aerial survey covered 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).

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
Aug 2002	S. Gulf of Maine to Maine	6,460	0.74
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.	84,000	0.36

	Lawrence		
July-Aug 2007	N. Labrador to Scotian Shelf	53,625	0.22

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 120,743 animals (CV=0.23) derived from the 2004 surveys. The minimum population estimate for the western North Atlantic common dolphin is 99,975.

Current Population Trend

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 99,975 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~~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~~ (Wade and Angliss 1997). PBR for the western North Atlantic stock of common dolphin is 1,000.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during ~~2003~~2004-~~2007~~ 2008 was ~~160~~ 167 (CV=0.~~10~~11) common dolphins (Table 2).

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

Four common dolphins were observed taken in northeast sink gillnet fisheries in 2005, one in 2006 and 1 in 2007. 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, and 11 (1.08) in 2007. The 2003-2007 average annual mortality attributed to the northeast sink gillnet was 11 animals (CV=0.54). This fishery, which extends from North Carolina to New York, is actually a combination of small vessel fisheries that target a variety of fish species, some of which operate right off the beach. The number of vessels in this fishery is unknown, because records which are held by both state and federal agencies have not been centralized and standardized.

Mid-Atlantic Gillnet

One common dolphin was taken in an observed trip during 2006. Two common dolphins were observed taken in 1995, 1996 and 1997, and no takes were observed from 1998 to 2005, or in 2007 - 2008. 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), and 0 in 1998-2005, 11 (1.03) in 2006, ~~and~~ 0 in 2007, and 0 in 2008. Average annual estimated fishery-related mortality attributable to this fishery during ~~2003~~2004-~~2007~~ 2008 was 2 (CV = 1.03) common dolphins (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. One common dolphin was observed taken in 2002, ~~three~~ 3 in 2004, ~~five~~ 5 in 2005, 1 in 2006, ~~and~~ 3 in 2007, and 1 in 2008. (Table2). 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, ~~and~~ 24 (0.28) in 2007, and 17 (0.29) in 2008. The ~~2003~~2004-~~2007~~ 2008 average annual mortality attributed to the northeast bottom trawl was ~~27~~ 25 animals (CV=0.~~12~~13).

Mid-Atlantic Bottom Trawl

Three common dolphins were observed taken in mid-Atlantic bottom trawl fisheries in 2000, ~~two~~ 2 in 2001, ~~nine~~ 9 in 2004, 15 in 2005, 14 in 2006, ~~and~~ 0 in 2007, and 1 in 2008 (Table 2). The estimated annual fishery-related mortality and serious injury attributable to the 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, ~~and~~ 66 (0.27) in 2007, and 108 (0.28) in 2008. The ~~2003~~2004-~~2007~~ 2008 average annual mortality attributed to the mid-Atlantic bottom trawl was ~~119~~ 121 animals (CV=0.~~12~~13).

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

2007 was the first year a short-beaked common dolphin mortality had been observed in this fishery. 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. com.). 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 ~~2003~~2004-~~2007~~ 2008 average annual mortality attributed to the mid-Atlantic mid-water trawl was 1 (0.70) animal.

Table 2. Summary of the incidental mortality of short-beaked common dolphins (*Delphinus delphis delphis*) 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 [a]	Years	Data Type [b]	Observer Coverage [c]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet	~~03~~04-~~07~~08	Obs. Data, Trip Logbook, Allocated Dealer Data	~~.03,~~ .06, .07, .04, .07, .05	0, 0, 0, 0, 0	~~0,~~ 0, 4, 1, 1, 2	0, 0, 0, 0, 0	~~0,~~ 0, 26, 20, 11, 3~~5~~3	~~0,~~ 0, 26, 20, 11, 3~~5~~3	~~0,~~ 0, .8, 1.05, 1.08, .77	~~11~~ 18 (0.~~54~~45)
Mid-Atlantic Gillnet	~~03~~04-~~07~~08	Obs. Data, Trip Logbook, Allocated Dealer Data	.01, .02, .03, .04, .~~06~~03	0, 0, 0, 0, 0	~~0,~~ 0, 0, 1, 0, 0	0, 0, 0, 0, 0	~~0,~~ 0, 0, 11, 0, 0	~~0,~~ 0, 0, 11, 0, 0	~~0,~~ 0, 0, 1.03, 0, 0	2 (1.03)
Mid-Atlantic Mid-water Trawl - Including Pair Trawl	~~20~~03~~4~~-~~20~~07~~8~~	Obs. Data Weighout Trip Logbook	~~.018,~~ .064, .084, .089, .039, .13	0, 0, 0, 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, 0, .70, 0	1 (.70)
Northeast Bottom Trawl [d]	~~03~~04-~~07~~08	Obs. Data Dealer Data VTR Data	~~.04,~~ .05, .12, .06, .06, .08	0, 0, 0, 0, 0	~~0,~~ 3, 5, 1, 3, 1	0, 0, 0, 0, 0	~~26,~~ 26, 32, 25, 24, 17	~~26,~~ 26, 32, 25, 24, 17	~~.29,~~ .29, .28, .28, .28, .29	~~27~~ 25 (.~~12~~13)
Mid-Atlantic Bottom Trawl [d]	~~03~~04-~~07~~08	Obs. Data Dealer	~~.01,~~ .03 , .03, .02, .03, .03	0, 0, 0, 0 , 0	~~0,~~ 9, 15, 14, 0, 1	0, 0, 0, 0, 0	~~99,~~ 159, 141, 131, 66, 108	~~99,~~ 159, 141, 131, 66, 108	~~.28,~~ .30, .20, .28, .27, .28	~~119~~ 121 (.~~12~~13)
TOTAL										~~160~~ 167 (.~~10~~11)

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 (Dealer reported 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. North Atlantic bottom trawl mid-Atlantic bottom trawl, and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips.

d. NE and MA bottom trawl mortality estimates reported for 2007 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2007 effort. ~~Complete documentation of methods used to estimate cetacean bycatch mortality are described in 'Estimated Bycatch of Cetaceans in Northeast U.S. Bottom Trawl Fishing Gear' but is not available for distribution. The manuscript is expected to be published in early 2009.~~ NE and MA bottom trawl mortality estimates reported for 2008 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2008 effort (Rossman 2009). Because of this pooling, years with no observed mortality may still have a calculated estimate.~~(Rossman in press).~~

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)~~(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

From ~~2003~~ 2004 to ~~2007~~2008, ~~407~~ 414 common dolphins were reported stranded between Maine and Florida (Table 3). The total includes mass stranded common dolphins in Massachusetts during 2004 (one event of 6 animals and one of 3 animals), 2005 (a total of 43 in 4 separate events), 2006 (a total of 65 in 10 events), ~~and~~ 2007 (a total of 23 in 5 separate events) and 2008 (one event of 5 animals and one of 2 animals). Five of the 2005 Massachusetts stranded animals, 18 animals in 2006, ~~and~~ 2 animals in 2007, and 2 animals in 2008 were released alive. Common dolphins were included in the UME (unusual mortality event) declared for Virginia in 2004 (MMC 2005). The strandings were primarily bottlenose dolphins, but common dolphins were also involved. Human interactions were indicated on one of the 2004 Virginia common dolphin mortality records, one of the 2005 and 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.

Four common dolphin strandings (6 individuals) were reported on Sable Island, Nova Scotia from 1996 to 1998 (Lucas and Hooker 1997; 2000). One common dolphin was reported stranded in Halifax County, Nova Scotia in 2005 and one was reported stranded in 2008 (Tonya Wimmer, pers. comm.).

~~Table 3. Short-beaked common dolphin (*Delphinus delphis*) reported strandings along the U.S. Atlantic coast, 2003-2007.~~

~~STATE~~	~~2003~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	~~TOTALS~~
~~Maine~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~	~~1~~
~~Massachusetts[a]~~	~~22~~	~~26~~	~~64~~	~~100~~	~~65~~	~~277~~
~~Rhode Island~~	~~2~~	~~1~~	~~0~~	~~2~~	~~4~~	~~9~~
~~Connecticut~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~New York[b, c]~~	~~11~~	~~3~~	~~4~~	~~3~~	~~23~~	~~44~~
~~New Jersey~~	~~6~~	~~17~~	~~4~~	~~2~~	~~4~~	~~33~~
~~Delaware~~	~~1~~	~~2~~	~~1~~	~~0~~	~~0~~	~~4~~
~~Maryland~~	~~0~~	~~5~~	~~0~~	~~0~~	~~0~~	~~5~~
~~Virginia[b, c]~~	~~4~~	~~8~~	~~2~~	~~1~~	~~4~~	~~19~~
~~North Carolina~~	~~7~~	~~4~~	~~1~~	~~2~~	~~0~~	~~14~~
~~Georgia~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Florida~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~EZ~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~
~~TOTALS~~	~~53~~	~~67~~	~~76~~	~~110~~	~~101~~	~~407~~

~~a. Massachusetts mass strandings (2004 - 6 and 3; 2005 - 7,5,25, and 4; 2006 - 2,2,3,4,4,3,9,10,14, and 14; 2007 - 9,2,4,6,2).~~

~~b. Virginia reports 1 common dolphin found in a pound net in 2004. One common dolphin was released alive from a pound net in 2006 in NY. Twenty (12 dead, 8 rescued; one of the mortalities classified as human interaction) animals involved in a mass stranding in Suffolk county in 2007.~~

~~c. One 2005 and one 2007 mortality in New York reported as having human interactions and one in VA in 2006.~~

Table 3. Short-beaked common dolphin (*Delphinus delphis*) reported strandings along the U.S. Atlantic coast, 2004-2008.

STATE	2004	2005	2006	2007	2008	TOTALS
Maine	0	0	0	1	0	1
Massachusetts[a]	26	64	100	65	19	274
Rhode Island	1	0	2	4	3	10
New York [b, c]	3	4	3	23	2	35
New Jersey	17	4	2	4	9	36
Delaware[c]	2	1	0	0	2	5
Maryland	5	0	0	0	2	7
Virginia[b, c]	8	2	1	4	22	37
North Carolina[c]	4	1	2	0	1	8
EZ	1	0	0	0	0	1
TOTALS	67	76	110	101	60	414

a. Massachusetts mass strandings (2004 - 6 and 3; 2005 - 7,5,25, and 4; 2006 - 2,2,3,4,4,3,9,10,14, and 14; 2007 - 9,2,4,6,2; 2008 - 5 and 2).

b. Virginia reports 1 common dolphin found in a pound net in 2004. One common dolphin was released alive from a pound net in 2006 in NY. 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 interation). In addition, in 2009 3 animals were relocated from the Nansemond River.

c. One 2005 mortality in New York reported as having human interaction and one in VA in 2006. Seven records with signs of human interaction in 2009 - 3 from Virginia, 1 from Massachuisetts, one from North Carolina, and one from Delaware. Of these, 4 were 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

The status of short-beaked common 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 trends for this species. 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 ~~2002~~2004-~~2006~~ 2008 average annual human-related mortality does not exceed PBR; therefore, this is not a strategic stock.

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~~December 2009~~~~January~~March 2010

HARBOR PORPOISE (*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 Program. 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 the northern edge of 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).

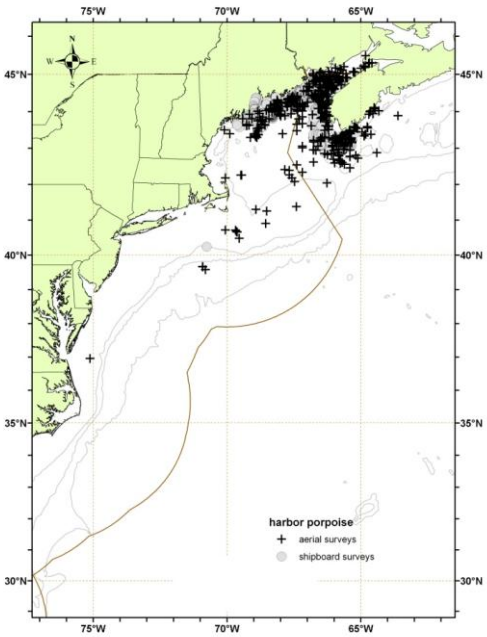

Figure 1. *Distribution of harbor porpoises from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006 and 2007. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

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. ~~Recent a~~Analyses involving mtDNA (Wang *et al.* 1996; Rosel *et al.* 1999a; Rosel *et al.* 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 in 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, eight line-transect sighting surveys were conducted during the summers of 1991, 1992, 1995, 1999, 2002, 2004, 2006, and 2007. The best current abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is 89,054 (CV=0.47), based on the 2006 survey results (Table 1). This is because the 2006 estimate covered the largest portion of the harbor porpoise range.

An abundance estimate of 64,047 (CV=0.48) harbor porpoises was derived from an aerial survey conducted in August 2002 which 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). The value of g(0) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.

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 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 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 abundance estimate of 89,054 (CV=0.47) harbor porpoises 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.).

An abundance estimate of 4,862 (95%CI=2,204-8,801) harbor porpoises from the Gulf of Maine/Bay of Fundy, Gulf of ~~Saint~~ St. Lawrence, and Newfoundland stocks was generated from the Canadian Trans North Atlantic Sighting Survey (TNASS) in July-August 2007. This aerial survey covered 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, 2009 #1069}

Table 1. Summary of recent abundance estimates for the Gulf of Maine/Bay of Fundy harbor porpoise. 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
Aug 2002	S. Gulf of Maine to Maine	64,047	0.48
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	Northern Labrador-Scotian Shelf	4,862	0.31

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 harbor porpoises is 89,054 (CV=0.47). The minimum population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 60,970.

Current Population Trend

A 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 60,970. 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 703.

ANNUAL HUMAN-CAUSED MORTALITY

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 4).

The total annual estimated average human-caused mortality is 9~~40~~28~~860~~+ (CV=0.16~~2~~) harbor porpoises per year. This is derived from four components: 8~~89~~77~~07~~ harbor porpoise per year (CV=0.1~~6~~5~~2~~) from most U.S. fisheries using observer and MMAP data, an unknown number for the Northeast bottom trawl fishery, 45 per year (unknown CV) from Canadian fisheries using observer data, and 6~~7.5~~ per year from unknown U.S. fisheries using strandings data.

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, Northeast bottom trawl and in the Canadian Bay of Fundy groundfish sink gillnet and herring weir fisheries (Table 2). Detailed U.S. fishery information is reported in Appendix III.

Earlier Interactions

One harbor porpoise was observed taken from 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.

U.S.

Northeast Sink Gillnet

In 1984 the Northeast sink gillnet fishery was investigated by a sampling program that collected information concerning marine mammal bycatch. Approximately 10% of the vessels fishing in Maine, New Hampshire, and Massachusetts were sampled. Among the 11 gillnetters who received permits and logbooks, 30 harbor porpoises were reported caught. It was estimated, using rough estimates of fishing effort, that a maximum of 600 harbor porpoises were killed annually in this fishery (Gilbert and Wynne 1985; Gilbert 1987).

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 during 1990-2007 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, ~~and~~ 395 (0.37) in 2007, and ~~720~~666 (0.48) in 2008 (Table 2). 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.

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 2004~~3~~ to 2008~~7~~ was 5~~8~~372~~57~~ (0.17~~4~~) (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 were 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, ~~and~~ 58 (1.03) in 2007, and 35~~3~~0 (0.7~~6~~5) in 2008. 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 ~~2003~~ 2004 to 2008~~7~~ was ~~250~~ 30~~6~~5 (0.~~26~~3427) (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. ~~Nineteen~~ Twenty harbor porpoise mortalities were observed in the Northeast bottom trawl fishery between 1989 and ~~2007~~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, ~~and~~ 1 in 2006, and 1 in 2008. Estimates have not been generated for this fishery.

Unknown Fishery

The strandings and entanglement database, maintained by the New England Aquarium and the Northeast Regional Office/NMFS, reported 228, 27, 113, 79, 122, 118, 174, 73, ~~and~~ 79, and 58 stranded harbor porpoises on U.S. beaches during 1999 to ~~2007~~2008, respectively (see Other Mortality section for more details). Of these, it was determined that the cause of death of 19, 1, 3, 2, 9, and 6 stranded harbor porpoises in 1999 to 2004, respectively, were due to unknown fisheries and these animals were in areas and times that were not included in the above

mortality estimate derived from observer program data (Table 3). As of 2005, the cause of death of stranded animals is not being evaluated and so will not be included in annual human-induced mortality estimates. The ~~two-year average~~ harbor porpoise mortality and serious injury in this unknown fishery category f~~r~~orm ~~2003 to~~ 2004 is 6.0~~7.5~~ (CV is unknown).

CANADA

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. No harbor porpoises were observed taken.

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.

More recently, 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 September 1-7. 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 was 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~~2003-2007 removals~~.

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, ~~an~~ additional ~~751~~ harbor porpoises have been documented in Canadian herring weirs where the number of ~~, of which 687 were released or escaped, 41 died, and 23 had an unknown status. M~~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 and 0 (8, 6) in 2008 (Neimanis *et al.* 2004; H. Koopman

and A. Westgate, pers. comm.).

Average estimated harbor porpoise mortality in the Canadian herring weir fishery during 2004~~3~~-2008~~7~~ was 1.8~~2.0~~ (Table 2). An estimate of variance is not possible.

Gulf of St. Lawrence gillnet

This fishery interacts with the Gulf of St. Lawrence harbor porpoise stock, not the Gulf of Maine/Bay of Fundy harbor porpoise stock. Using questionnaires to fishermen, Lesage *et al.* (2006) determined a total of 2215 (95% CI 1151-3662) and 2394 (95% CI 1440-3348) harbor porpoises were taken in 2000 and 2001, respectively. The largest takes were in July and August around Miscou and the North Shore of the Gulf of St. Lawrence. According to the returned questionnaires, the fish species most usually associated with incidental takes of harbor porpoises include Atlantic cod, herring and mackerel. An at-sea observer program was also conducted during 2001 and 2002. However, due to low observer coverage that was not representative of the fishing effort, Lesage *et al.* (2006) concluded that resulting bycatch estimates were unreliable.

Newfoundland gillnet

This fishery interacts with the Newfoundland harbor porpoise stock, not the Gulf of Maine/Bay of Fundy harbor porpoise stock. Estimates of incidental catch of small cetaceans, where the vast majority are likely harbor porpoises was 862 in 2001, 1,428 in 2002, and 2,228 in 2003 for the Newfoundland nearshore cod and Greenland halibut fisheries, and the Newfoundland offshore fisheries in lumpfish, herring, white hake, monkfish and skate (Benjamins *et al.* 2007) .

Table 2. From observer program data, summary of the incidental mortality of harbor porpoise (*Phocoena phocoena*) 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 Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
U.S.							
Northeast Sink Gillnet[c]	~~03~~04-~~07~~08	Obs. Data, Weighout, Trip Logbook	~~.03,~~ .06, .07, .04, .07, .05	~~12[e],~~ 27[e], 51[e], 26, 35, 30	~~592,~~ 654[e], 630[e], 514, 395, ~~720~~666	~~.33,~~ .36, .23, .31, .37, .48	~~5575~~8372 (~~0.14~~0.17)
Mid-Atlantic Gillnet	~~03~~04-~~07~~08~~4~~	Obs. Data Weighout	~~.01,~~ .02, .03, .04, .06, .03	~~1,~~ 2, 15, 20, 1, 9	~~76,~~ 137, 470, 511, 58, 35~~3~~0	~~1.13,~~ .91, .51, .32, 1.03, .76~~5~~	~~250~~3065 (0.~~26~~3427)
Northeast bottom trawl[g]	~~03~~04-~~07~~08~~4~~	Obs. Data Weighout	~~.04,~~ .05, .12, .06, .06, .08	~~1,~~0,4,1, 0, 1	~~unk[i],~~0,unk[i], unk, 0, unk	~~unk,~~ 0, unk, unk, 0, unk	unk[i,g]
U.S. TOTAL	2004~~3~~-2008~~7~~						8~~89~~770~~7~~ (0.16~~5~~2)
CANADA							
Bay of Fundy Sink Gillnet[f]	1997-2001~~07~~	Can. Trips	unk	19, 5, 3, 5, 39	43~~34~~, 38, 32, 28, 73	unk	43[f] (unk)
Herring Weir	04~~3~~-08~~7~~	Coop. Data	unk	~~1,~~ 4, 0, 2, 3, 0	~~1,~~ 4, 0, 2, 3, 0	NA	1.8~~2.0~~ (unk)
CANADIAN TOTAL	2004~~3~~-2008~~7~~						45 (unk)
GRAND TOTAL							9~~3~~422~~850~~+ (unk)

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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, 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. O~~The o~~bserver coverage~~s~~ for the ~~U.S. and Canadian sink gillnet fisheryies~~ is~~are ratios based on trips, and for the~~ U.S. Northeast and mid-Atlantic coastal gillnet fisheries~~y~~, ~~the coverage unit of effort~~ is based on tons of fish landed.

c. During 2002-2008 in the Northeast gillnet fishery~~7~~, 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, ~~and~~ 9 and 6 observed harbor porpoise takes on pinger trips from 1992 to 2008~~7~~, 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, ~~and~~ 7, and 13 observed harbor porpoise takes in 1995 to 2008~~7~~, respectively, on trips dedicated to fish sampling versus dedicated to watching for marine mammals; these were also included in the observed mortality column (Bisack 1997).

d. There were 255 licenses for herring weirs in the Canadian Bay of Fundy region.

e. There were 22 active weirs around Grand Manan. The number of weirs elsewhere is unknown.

f~~h~~. The Canadian gillnet fishery was not observed during 2002 and afterwards, but the fishery is still active; thus, the bycatch estimate is estimated using past averages.

g~~i~~. Estimates of bycatch mortality attributed to the Northeast bottom trawl fishery have not been generated.

Table 3. From strandings and entanglement data, summary of confirmed incidental mortality of harbor porpoises (*Phocoena phocoena*) by fishery: includes years sampled (Years), ~~number of vessels active within the fishery (Vessels),~~ type of data used (Data Type), mortalities assigned to this fishery (Assigned Mortality), and mean annual mortality.

Fishery	Years	Data Type [a]	Assigned Mortality	Mean Annual Mortality
Unknown gillnet fishery	~~03~~04-~~07~~08	Entanglement & Strandings	~~9,~~ 6, unk[b], unk[b], unk[b], unk[b]	~~7.5~~6
TOTAL				~~7.5~~6

NA=Not Available.

a Data from records in the entanglement and strandings data base maintained by the New England Aquarium and the Northeast Regional Office/NMFS (Entanglement and Strandings).

b. As of 2005, the cause of death of stranded animals is not being evaluated and so will not be included in annual human-induced mortality estimates. Thus, the annual mortality is ~~an~~that from ~~average from the years 2003~~ 2004.

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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 2003, 122 harbor porpoises were reported stranded (Table 4). The number of reported fishery interactions by state are: 1 in Massachusetts (October), 1 in Maryland (March), 6 in Virginia (3 in March, 2 in April, and 1 in May), and 1 in North Carolina (February). Three harbor porpoises were reported mutilated in North Carolina. All of these strandings reported with fishery interactions were in areas and times that were not part of a bycatch estimate derived from the observer data (Table 3).

During 2004, 117 harbor porpoises were reported stranded on Atlantic US beaches. There were 8 reported fishery interactions by state: 1 in Massachusetts (May), 1 in New York (May), and 3 in Virginia (February, March, and April), and 3 in North Carolina (April). In addition, there was 1 mutilation in Delaware during March. Of these 8 fishery interactions, six were in areas and times that were not part of a bycatch estimated derived from the observer data (Table 3).

During 2005, 175 harbor porpoises were reported stranded on Atlantic US beaches. Although 24 animals were classified as having signs of human interaction, and of those 24, 7 showed signs of fishery interaction, in no case was cause of death directly attributable to these interactions. An Unusual Mortality Event was declared for harbor porpoise in North Carolina, as there were 38 stranded in that state between 1 January and 28 March 2005. Most of these were young of the year, and histopathological examinations of 6 of these animals showed no– systemic diseases or common symptoms other than emaciation or any systemic disease (MMC 2006).

During 2006, 73 harbor porpoises were reported stranded on Atlantic US 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 US 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 US beaches. Of these, four were reported as having signs of human interaction. One of these was classified as a fishery interaction.

As of 2005, the cause of death of stranded animals is not being evaluated and so will not be included in annual human-induced mortality estimates. Using onlyAveraging 2003 to 2004, it is estimated that there were 7.56 animals per year that were stranded and mutilated and so cause of death was attributed to an unknown human-caused mortality (Table 3).

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 4. Harbor Porpoise (*Phocoena phocoena*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2003-2007.

Area	Year					Total
	2003	2004	2005	2006	2007	
Maine	5	15	9	9	10	**48**
New Hampshire	2	2	0	1	0	**5**
Massachusetts[a]	35	49	55	23	22	**184**
Rhode Island[b]	2	3	6	3	1	**15**
Connecticut	0	0	1	0	0	**1**
New York[c]	8	8	15	11	10	**52**
New Jersey	5	14	17	6	5	**47**
Pennsylvania	0	0	1	0	0	**1**
Delaware	1	1	3	3	3	**11**
Maryland	5	2	4	2	0	**13**
Virginia	19	8	22	9	8	**66**
North Carolina[d]	39	15	42	6	20	**122**

~~Florida~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
~~**TOTAL U.S.**~~	~~**122**~~	~~**117**~~	~~**175**~~	~~**73**~~	~~**79**~~	~~**566**~~
~~Nova Scotia~~	~~3~~	~~4~~	~~6~~	~~4~~	~~4~~	~~21~~
~~**GRAND TOTAL**~~	~~**125**~~	~~**121**~~	~~**181**~~	~~**77**~~	~~**83**~~	~~**587**~~

~~a. In Massachusetts, during 2005, 2 animals were relocated and released. In 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.~~
~~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 relocated and released in 2005, and one was taken to rehab in2003 and one in 2006. The 2003 animal was tagged and released (Schofield *et al.* 2008).~~

Table 4. Harbor Porpoise (*Phocoena phocoena*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2004-2008.

Area	Year					**Total**
	2004	2005	2006	2007	2008	
Maine[a]	15	9	9	10	7	**50**
New Hampshire	2	0	1	0	0	**3**
Massachusetts[ab]	49	55	23	22	25	**174**
Rhode Island[be]	3	6	3	1	1	**14**
Connecticut	0	1	0	0	0	**1**
New York[ce]	8	15	11	10	3	**47**
New Jersey	14	17	6	5	8	**50**
Pennsylvania	0	1	0	0	0	**1**
Delaware	1	3	3	3	0	**10**
Maryland	2	4	2	0	2	**10**
Virginia	8	22	9	8	6	**53**
North Carolina[d]	15	42	6	20	6	**89**
Florida	0	0	0	0	0	**0**
TOTAL U.S.	**117**	**175**	**73**	**79**	**58**	**502**
Nova Scotia	3	5~~4~~	4~~6~~	4	6	~~**16**~~**22**~~**7**~~
Newfoundland and New Brunswick	0	5	0	1	4	**10**
GRAND TOTAL	**120**	**185~~4~~**	**77~~9~~**	**84**	**62**	**5~~28~~34~~9~~**

a. In Massachusetts, during 2005, 2 animals were relocated and released. In 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 relocated and released in 2005, ~~and~~ one animal was taken to rehab ~~in2003 and one~~ in 2006, and one animal immediately released in 2008. ~~The 2003 animal was tagged and released (Schofield *et al.* 2008).~~

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded between 1991 and 1996 on the

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coast of Nova Scotia (Hooker *et al.* 1997). Researchers with the Canadian Department~~t.~~ 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 between 1997 and ~~2007~~ 2008 on the coast of Nova Scotia as recorded by the Marine Animal Response Society and the Nova Scotia Stranding Network are as follows (Table 4): 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), ~~and~~ 4 in 2007, and ~~xx~~6 in 2008 (Table 4).

FFive dead stranded harbor porpoises were reported in 200~~8~~5 by the Newfoundland and Labrador Whale Release and Strandings Program, 1 in 2007 and 4 in 2008. (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009~~(Ledwell 2009)~~

USA management measures taken to reduce bycatch

A ruling to reduce harbor porpoise bycatch in USA 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 plan 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. NMFS is currently undertaking rule-making to modify the plan.

STATUS OF STOCK

The status of harbor porpoises, relative to OSP, in the U.S. Atlantic EEZ is unknown. On 7 January 1993, the National Marine Fisheries Service (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). Population trends for this species have not been investigated. 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. This is a strategic stock because average annual human-related mortality and serious injury exceeds PBR.

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