

ATLANTIC SPOTTED DOLPHIN (*Stenella frontalis*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin, *Stenella frontalis*, formerly *S. plagiodon*, and the pantropical spotted dolphin, *S. attenuata* (Perrin *et al.* 1987). The Atlantic spotted dolphin occurs in two forms which may be distinct sub-species (Perrin *et al.* 1987, 1994; Rice 1998): the large, heavily spotted form which inhabits the continental shelf and is usually found inside or near the 200m isobath; and the smaller, less spotted island and offshore form which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Fulling *et al.* 2003; Mullin and Fulling 2003; Mullin and Fulling 2004). Where they co- occur, the offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea

Atlantic spotted dolphins are distributed in tropical and warm temperate waters of the western North Atlantic (Leatherwood *et al.* 1976). Their distribution is from southern New England, south through the Gulf of Mexico and the Caribbean to Venezuela (Leatherwood *et al.* 1976; Perrin *et al.* 1994). The large, heavily spotted form of the Atlantic spotted dolphin along the southeastern and Gulf coasts of the United States, which may warrant designation as a distinct sub-species (Rice 1998), inhabits the continental shelf, usually being found inside or near the 200 m isobath (within 250-350 km of the coast) but sometimes coming into very shallow water adjacent to the beach (Figure 1). Off the northeast U.S. coast, spotted dolphins are widely distributed on the continental shelf, along the continental shelf edge, and offshore over the deep ocean south of 40° N (CETAP 1982). Atlantic spotted dolphins regularly occur in the inshore waters south of Chesapeake Bay and near the continental shelf edge and continental slope waters north of this region (Payne *et al.* 1984; Mullin and Fulling 2003). Sightings have also been made along the north wall of the Gulf Stream and warm-core ring features (Waring *et al.* 1992). Stock structure in the western North Atlantic is unknown.

POPULATION SIZE

Total numbers of Atlantic spotted dolphins off the U.S. or Canadian Atlantic coast are unknown, although estimates from selected regions of the habitat do exist for select time periods. Because *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. Sightings were concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras, with sightings extending into the deeper slope and offshore waters of the Mid-Atlantic (Fig. 1).

An abundance of 6,107 undifferentiated spotted dolphins (CV=0.27) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

An abundance of 4,772 (CV=1.27) undifferentiated spotted dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; Palka *et al.* Unpublished Manuscript). Total track line length was 32,600km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters

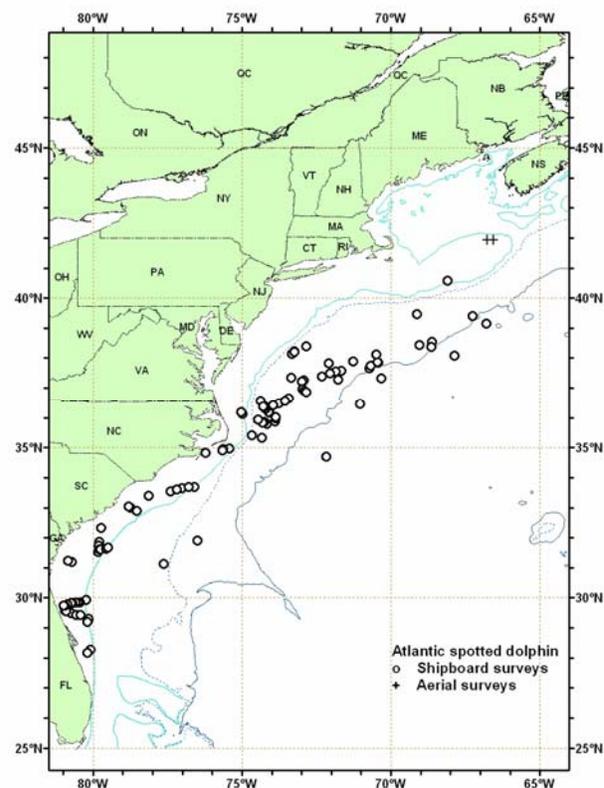


Figure 1. Distribution of Atlantic spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.

in the Mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 32,043 (CV=1.39) for offshore Atlantic spotted dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* Unpublished Manuscript). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 14,438 (CV=0.63) for Atlantic spotted dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163km of track line in waters south of Maryland (38°N) (Figure 1; Mullin and Fulling 2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 2001) where school size bias and ship attraction were accounted for.

An abundance of 3,578 (CV= 0.48) for Atlantic spotted dolphins was estimated from a line transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38° N) to the Bay of Fundy (45° N) (Figure 1; Palka unpublished manuscript). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and $g(0)$, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for $g(0)$ and biases due to school size and other potential covariates (Figure 1; Palka Unpublished Manuscript).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥ 50 m) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the Mid-Atlantic. The survey included 5,659 km of trackline, and there were a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were analyzed to correct for visibility bias ($g(0)$) and group-size bias employing line transect distance analysis and the direct duplicate estimator (Palka 1995; Buckland *et al.*, 2001). The resulting abundance estimate for Atlantic spotted dolphins between Florida and Maryland was 47,400 (CV=0.45).

At their November 1999 meeting, the Atlantic SRG recommended that, without a genetic determination of stock structure, the abundance estimates for the coastal and offshore forms should be combined. There remains debate over how distinguishable both species are at sea, though in the waters south of Cape Hatteras identification to species is made with very high certainty. This does not, however, account for the potential for a mixed species herd, as has been recorded for several dolphin assemblages. Pending further genetic studies for clarification of this problem, a single species abundance estimate will be used as the best estimate of abundance, combining species specific data from the northern as well as southern portions of the species' ranges. This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat. The best 2004 abundance estimate for Atlantic spotted dolphins is the sum of the estimates from the two 2004 western U.S. Atlantic surveys, 50,978 (CV=0.42), where the estimate from the northern U.S. Atlantic is 3,578 (CV=0.48), and from the southern U.S. Atlantic is 47,400 (CV=0.45).

Table 1. Summary of abundance estimates for both undifferentiated spotted dolphins (1995), and differentiated Atlantic spotted dolphins (1998 and 2004). 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 |
|--------------|--|---------------------|------|
| Jul-Sep 1998 | Maryland to Gulf of St. Lawrence | 32,043 ¹ | 1.39 |
| Jul-Aug 1998 | Florida to Maryland | 14,438 ³ | 0.63 |
| Jul-Sep 1998 | Florida to Gulf of St. Lawrence (COMBINED) | 46,481 ² | 0.98 |
| Jun-Aug 2004 | Maryland to Bay of Fundy | 3,578 | 0.48 |
| Jun-Aug 2004 | Florida to Maryland | 47,400 | 0.45 |
| Jun-Aug 2004 | Florida to Bay of Fundy (COMBINED) | 50,978 ² | 0.42 |

¹ This represents the first estimate for the offshore Atlantic spotted dolphin.

² This is the combined estimate for the two survey regions

³ This estimate is a recalculation of the same data reported in previous SARs. For more details see Mullin and Fulling 2003.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best abundance estimate is 50,978 (CV=0.42). The minimum population estimates based on the combined offshore and coastal abundance estimates is 36,235.

Current Population Trend

There are insufficient data to determine the population trends for this species, given that surveys prior to 1998 did not differentiate between species of spotted dolphins.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Atlantic spotted dolphin is 36,235. The maximum productivity rate is 0.04, the default value for cetaceans. The “recovery” factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is set to 0.5 because this stock is of unknown status. PBR for the combined offshore and coastal forms of Atlantic spotted dolphins is 362.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality or serious injury to this stock during 1999-2003 was zero Atlantic spotted dolphins (*Stenella* spp.) (Yeung 2001; Garrison 2003; Garrison and Richards, 2004).

Earlier Interactions

No spotted dolphin mortalities were observed in 1977-1991 foreign fishing activities. Bycatch had been observed by NMFS Sea Samplers in the pelagic drift gillnet and pelagic longline fisheries, but no mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast sink gillnet, Mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries; and no takes have been documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Forty-nine undifferentiated spotted dolphin mortalities were observed in the drift gillnet fishery between 1989 and 1998 and occurred northeast of Cape Hatteras within the 183m isobath in February-April and near Lydonia Canyon in October. Six whole animal carcasses that were sent to the Smithsonian were identified as Pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), no fishery in 1997 and 0 in 1998.

The pelagic longline fishery operates in the U.S. Atlantic (including Caribbean) and Gulf of Mexico EEZ. Interactions between the pelagic longline fishery and spotted dolphins have been reported; however, a vessel may fish in more than one statistical reporting area and it is not possible to separate estimates of fishing effort other than to subtract Gulf of Mexico effort from Atlantic fishing effort, which includes the Caribbean Sea. From 1999-2003, excluding the Gulf of Mexico, where one animal was hooked and released alive (Appendix 1), no Atlantic spotted dolphin bycatches were recorded.

Other Mortality

From 1999-2003, 17 Atlantic spotted dolphins were stranded between Massachusetts and Florida (NMFS unpublished data). One animal stranded in North Carolina in 1999, 3 animals stranded in North Carolina and 1 stranded in Georgia in 2000, 2 animals stranded in North Carolina and 3 in Florida in 2001, 2 animals stranded in North Carolina and 2 in Florida in 2002, and 1 animal stranded in Massachusetts, 1 in North Carolina and 1 in Florida in 2003. None of these strandings had documented signs of human 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.

| STATE | 1999 | 2000 | 2001 | 2002 | 2003 | TOTALS |
|----------------|------|------|------|------|------|--------|
| Massachusetts | 0 | 0 | 0 | 0 | 1 | 1 |
| North Carolina | 0 | 3 | 2 | 2 | 1 | 8 |
| South Carolina | 1 | 0 | 0 | 0 | 0 | 1 |
| Georgia | 0 | 1 | 0 | 0 | 0 | 1 |
| Florida | 0 | 0 | 3 | 2 | 1 | 6 |
| TOTALS | 1 | 4 | 5 | 4 | 3 | 17 |

STATUS OF STOCK

The status of Atlantic spotted 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. Total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual fishery-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock.

REFERENCES

- Barlow, J., S. L. Swartz, T. C. Eagle and P. R. Wade. 1995. U.S. Marine mammal stock assessments: Guidelines for preparation, background, and a summary of the 1995 assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-6, 73pp. Available from NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA, 92037-1508.
- Buckland, S. T., D. R. Anderson, K. P. Burnham, J. L. Laake, D. L. Borchers and L. Thomas. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, New York, 432 pp.
- CETAP. 1982. A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the U.S. outer continental shelf. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report, Contract AA51-C78-48, Bureau of Land Management, Washington, DC, 538 pp.
- Garrison, L.P. 2003. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2001-2002. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFSC-515, 52 pp. Available from NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Road, Miami, FL 33149.
- Garrison, L.P. and P.M. Richards. 2004. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2003. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFSC-527, 57 pp. Available from NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Road, Miami, FL 33149.
- Hiby, L. 1999. The objective identification of duplicate sightings in aerial survey for porpoise. pp. 179-189. *In*: G.W. Garner, S. C. Amstrup, J. L. Laake, B. F. J. Manly, L. L. McDonald, and D. G. Robertson (eds.) Marine mammal survey and assessment methods. Balkema, Rotterdam. 287 pp.
- Leatherwood, S., D. K. Caldwell and H. E. Winn. 1976. Whales, dolphins, and porpoises of the western North Atlantic. A guide to their identification. NOAA Tech. Rep. NMFS Circ. 396, U.S. Dept. Commer. Washington, DC 176 pp.
- Mullin, K. D. and G. L. Fulling. 2003. Abundance and cetaceans in the southern U.S. Atlantic Ocean during summer 1998. Fish. Bull., U.S. 101:603-613.
- Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. pp. 27-50 *In*: A. Bjørge and G.P. Donovan (eds.) *Biology of the Phocoenids*. Rep. Int. Whal. Commn., Special Issue 16: i-x + 552 pp.
- Palka, D. 1996. Update on abundance of Gulf of Maine/Bay of Fundy harbor porpoises. NOAA/NMFS/NEFSC. Ref. Doc. 96-04; 37 pp. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.
- Palka, D. and P.S. Hammond. 2001. Accounting for responsive movement in line transect estimates of abundance. Can. J. Fish. Aquat. Sci. 58: 777-787.
- Payne, P. M., L. A. Selzer and A. R. Knowlton. 1984. Distribution and density of cetaceans, marine turtles, and seabirds in the shelf waters of the northeastern United States, June 1980-December 1983, based on shipboard observations. NOAA/NMFS Contract No. NA-81-FA-C-00023. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.
- Perrin, W. F., E. D. Mitchell, J. G. Mead, D. K. Caldwell, M. C. Caldwell, P. J. H. van Bree, and W. H. Dawbin. 1987. Revision of the spotted dolphins, *Stenella* sp. *Mar. Mamm. Sci.* 3(2): 99-170.
- Perrin, W. F., D. K. Caldwell, and M. C. Caldwell. 1994. Atlantic spotted dolphin. pp.173-190. *In*: S. H. Ridgway and R. Harrison (eds.). Handbook of marine mammals, Volume 5: The first book of dolphins. Academic Press, San Diego, 418 pp.

- Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. pp. 133-147. *In*: W.F. Perrin, G.P. Donovan and J. Barlow (eds.) Gillnets and Cetaceans. Rep. Int. Whal. Commn., Special Issue 15: I-ix + 629 pp.
- Rice, D. W. 1998. Marine mammals of the world, systematics and distribution. Spec. Publ. No 4. Society for The Society for Marine Mammalogy, Lawrence, KS. 231 pp.
- Wade, P.R., and R.P. Angliss. 1997. Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop April 3-5, 1996, Seattle, Washington. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-OPR-12, 93 pp. Available from: NOAA, National Marine Fisheries Service, 166 Water St., Woods Hole, MA 02543.
- Waring, G. T., C. P. Fairfield, C. M. Ruhsam and M. Sano. 1992. Cetaceans associated with Gulf Stream features off the northeastern USA shelf. ICES Marine Mammals Comm. CM 1992/N:12, 29 pp.
- Yeung, C. 2001. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1999-2000. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFSC-467, National Marine Fisheries Service, Miami, FL, 43 pp. Available from NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Road, Miami, FL 33149.