PANTROPICAL SPOTTED DOLPHIN (Stenella attenuata): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin *et al.* 1987; Perrin and Hohn 1994). There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted

dolphin, *Stenella frontalis*, formerly *S. plagiodon*, and the pantropical spotted dolphin, *S. attenuata* (Perrin *et al.* 1987). The Atlantic spotted dolphin occurs in two forms which may be distinct sub-species (Perrin *et al.* 1987, Perrin and Hohn 1994; Rice 1998): the large, heavily spotted form which inhabits the continental shelf and is usually found inside or near the 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

Sightings of pantropical spotted dolphins in the northern Gulf of Mexico occur over the deeper waters, and rarely over the continental shelf or continental shelf edge (Mullin *et al.* 1991; SEFSC, unpublished data). Pantropical spotted dolphins were seen in all seasons during seasonal aerial surveys of the northern Gulf of Mexico, and during winter aerial surveys offshore of the southeastern U.S. Atlantic coast (SEFSC unpublished data). Some of the Pacific populations have been divided into different geographic stocks based on morphological characteristics (Perrin 1987; Perrin and Hohn 1994).

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

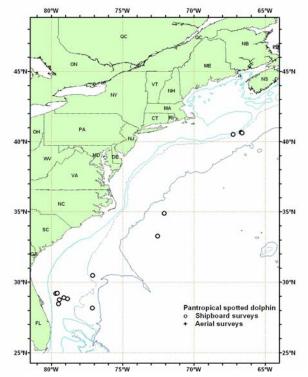


Figure 1. Distribution of pantropical spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m isobaths.

POPULATION SIZE

Total numbers of pantropical spotted dolphins off the U.S. or Canadian Atlantic coast are unknown, although estimates are available from selected regions for select time periods. Sightings have been concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic (Fig. 1). The best recent abundance estimate for pantropical spotted dolphins is the sum of the estimates from the two 2004 western U.S. Atlantic surveys. This joint estimate (0+4,439=4,439) is considered best because these two surveys together have the most complete coverage of the species' habitat.

Because *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. At their November 1999 meeting, the Atlantic SRG recommended that without a genetic determination of stock structure, the abundance estimates for the coastal and offshore forms should be combined. There remains debate over how distinguishable both species are at sea, though in the waters south of Cape Hatteras identification to species is made with very high certainty. This does not, however, account for the potential for a mixed species herd, as has been recorded for several dolphin assemblages. Pending further genetic studies for clarification of this problem, a single species abundance estimate will be used as the best

estimate of abundance, combining species specific data from the northern as well as southern portions of the species' ranges.

Earlier abundance estimates

An abundance estimate of 6,107 undifferentiated spotted dolphins (CV=0.27) was obtained from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance estimate of 4,772 (CV=1.27) undifferentiated spotted dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (NMFS unpublished data). An abundance estimate of 343 (CV=1.03) pantropical spotted dolphins was derived from a line-transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N). An abundance estimate of 12,747 (CV=0.56) pantropical spotted dolphins was generated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38° N) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An abundance estimate of zero pantropical spotted dolphins was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38°N) to the Bay of Fundy (45°N) (Table 1; Palka 2006), as no dolphins of this species were observed. Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and g(0), the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for g(0) and biases due to school size and other potential covariates (Palka 2005).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths \geq 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 accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias g(0) and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for pantropical spotted dolphins between Florida and Maryland was 4,439 animals (CV=0.49)(Table 1).

<i>attenuata</i>) by m	undance estimates for the western North Atlantic pantropical sponth, year, and area covered during each abundance survey, an ficient of variation (CV)			
Month/Year	Month/Year Area			
Jun-Aug 2004	Maryland to the Bay of Fundy	0	0	
Jun Aug 2004	Waryland to the Day of Fundy	0	0	
Jun-Aug 2004	Florida to Maryland	4,439	0.49	

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for pantropical spotted dolphins is 4,439 (CV=0. 49) The minimum population estimate for pantropical spotted dolphins is 3,010.

Current Population Trend

There are insufficient data to determine population trends for this species, because prior to 1998 spotted dolphins were not differentiated during surveys.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for pantropical spotted dolphins is 3,010. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for pantropical spotted dolphins is 30.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total fishery-related mortality and serious injury cannot be estimated separately for the two species of spotted dolphins in the U.S. Atlantic EEZ because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that either species might have been subject to the observed fishery-related mortality and serious injury. Total annual estimated average fishery-related mortality or serious injury to this stock during 2001-2005 was 6 (CV=1) undifferentiated spotted dolphins.

Earlier Interactions

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

Bycatch has been observed in the pelagic longline fisheries (two dolphins hooked and released alive without serious injuries - one in the Mid-Atlantic Bight area in 1993, and one in the Gulf of Mexico in 1994) (Yeung 1999) Forty-nine undifferentiated spotted dolphin mortalities were observed in the drift gillnet fishery between 1989 and 1998 and occurred northeast of Cape Hatteras within the 183 m isobath in February-April, and near Lydonia Canyon in October. Six whole animal carcasses sent to the Smithsonian were identified as pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), no fishery in 1997 and 0 in 1998.

Pelagic Longline

Between 1992 and 2005, 2 spotted dolphins (recorded as Atlantic spotted dolphins) were hooked and released alive in the Atlantic, including one dolphin hooked and released alive with serious injuries in 2003 (in the Mid-Atlantic Bight fishing area), and one dolphin was released alive without serious injuries in 2005 (in the Sargasso fishing area) (Garrison and Richards 2004; Fairfield-Walsh and Garrison 2006.). The estimated fishery-related mortality to spotted dolphins in the U.S. Atlantic (excluding the Gulf of Mexico) attributable to this fishery between 2001-2005 was 6 (CV=1) (Table 2) (Garrison 2003, 2005; Garrison and Richards 2004; Fairfield-Walsh and Garrison 2006).

	commercia Data Typ observers,	al fishery in be), the ann the estimat Mortality)	cluding the ual observer ted annual m	years sample coverage ((nortality and	d (Years), the Observer Cov serious injur	e number of verage), the o y, the combine	vessels active observed mon ned annual est	within the f talities and s stimates of m	<i>la frontalis</i> ar ishery (Vessel serious injurie ortality and s an of the con	ls), the type o es recorded b erious injury	of data used y on-board (Estimated
Fishery	Years	Vessels ^a	Data Type ^b	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Pelagic Longline (excluding NED-E)	01-05	98, 87, 63, 60, 60	Obs. Data Logbook	.04, .05, .09, .09, .06	0, 0, 1, 0, 0	0, 0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 1, 0, 0	6 (1)
TOTAL											6(1)
b. O	Observer o Mandatory	data (Obs. I	Data) are used ata were use	d to measure	bycatch rates	s, and the dat		d within the I	Northeast Fish re collected a		0

Other Mortality

From 2001-2005, 3 pantropical spotted dolphins were stranded between South Carolina and Florida (Table 3; NMFS unpublished data). These include one animal stranded in Florida in both 2002 and 2003, and one animal stranded in South Carolina in 2004 as part of an Unusual Mortality Event (UME). A Mid-Atlantic Offshore Small Cetacean UME, was declared when 85 small cetaceans stranded from Maryland to Georgia between 3 July 2004 and 16 January 2005. The species involved are generally found offshore and are not expected to strand along the coast. Gross necropsies were conducted and samples were collected for pathological analyses (Hohn et al. 2006), though no single cause for the UME was determined. The authors could not "definitively conclude that there was or was not a causal link between anthropogenic sonar activity or environmental conditions (or a combination of these factors) and the strandings". Prior to this, 4 animals stranded in Florida in 1999. There were no documented signs of fishery or human interactions in any of these strandings.

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	2001	2002	2003	2004	2005	TOTALS
South Carolina	0	0	0	1 ^a	0	1
Florida	1	1	0	0	0	2
TOTALS	1	1	0	1	0	3

STATUS OF STOCK

The status of pantropical spotted dolphins, relative to OSP in the western 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 U.S.fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual human-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock

REFERENCES CITED

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. 1 982. 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.
- Fairfield-Walsh, C. and L.P. Garrison. 2006. Estimated Bycatch of Marine Mammals and Turtles in the U.S. Atlantic Pelagic Longline Fleet During 2005. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFSC-539, 52 pp. Available from NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Road, Miami, Fl 33149
- Fulling, G. L., K. D. Mullin and C. W. Hubard. 2003. Abundance and distribution of cetaceans in outer continental shelf waters of the U.S. Gulf of Mexico. Fish. Bull. 101:923-932.
- 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. 2005. Estimated bycatch of marine mammals and turtles in the U.S. Atlantic pelagic longline fleet during 2004. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFSC-531, 57 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.
- Mullin, K. D. and G. L. Fulling. 2003. Abundance of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. Fish. Bull., U.S. 101:603-613.
- Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico. OCS Study/MMS 91-0027. U.S. Dept. of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana, 108 pp.
- Mullin, K. D. and G. L. Fulling. 2004. Abundance of cetaceans in the oceanic northern Gulf of Mexico. Mar. Mamm. Sci. 20(4): 787-807.
- 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. 2005. Aerial surveys in the northwest Atlantic: estimation of g(0). In: Proceedings of the workshop on Estimation of g(0) in line-transect surveys of cetaceans, ed. F. Thomsen, F. Ugarte, and P.G.H. Evans. ECS Newletter No. 44 – Special Issue. April 2005. Pgs 12-7.
- Palka, D.L. 2006. Summer abundance estimates of cetaceans in US North Atlantic Navy Operating Areas. U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc. 06-03, 41 pp.
- 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. and A.A. Hohn. 1994. Pantropical spotted dolphin *Stenella attenuata*. Pp. 71-98 in: S. H. Ridgway and R. Harrison (eds.) Handbook of marine mammals, Vol. 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.

Yeung, C. 1999. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1992-1999. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-SEFSC-429, 23 pp. Available from: NMFS, Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL, 33149.