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

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of spotted dolphin in the Western Atlantic — the Atlantic spotted dolphin, *Stenella frontalis,* formerly *S. plagiodon* (Perrin *et al.* 1987), and the pantropical spotted dolphin, *S. attenuata*. These species are difficult to differentiate at sea.

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin *et al.* 1987; Perrin and Hohn 1994). Sightings of this species 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over the deeper waters, and rarely over the continental shelf or continental shelf edge (Mullin *et al.* 1991; SEFSC, unpublished data).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 recent seasonal aerial surveys of the northern Gulf of Mexico, and during recent winter aerial surveys offshore of the southeastern USA Atlantic coast (SEFSC unpublished data). Some of the Pacific populations have been divided into different geographic stocks based on morphological characteristics (Perrin *et al.* 1987; Perrin and Hohn 1994); however, there is no information on stock differentiation in the Atlantic population.

POPULATION SIZE

Total numbers of pantropical spotted dolphins off the USA or Canadian Atlantic coast are unknown, although three 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 almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 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.* in review). Total track line length was 32,600 km. 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 in the mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine,
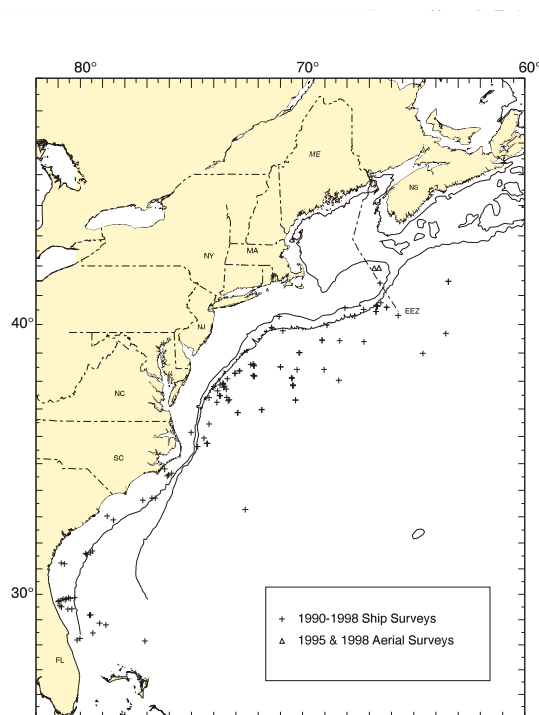

Figure 1. *Distribution of spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1990-1998. Isobaths are at 100 m and 1,000 m.*

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 343 (CV=1.03) for pantropical 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 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* in review). 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 12,774 (CV=0.57) for pantropical spotted dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 5,570 km of track line in waters south of Maryland (38°N) (Figure 1; Mullin in review). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) where school size bias and ship attraction were accounted for.

The best available abundance estimate for pantropical spotted dolphins is the sum of the estimates from the two 1998 USA Atlantic surveys, 13,117 (CV=0.36), where the estimate from the northern USA Atlantic is 343 (CV=1.03) and from the southern USA Atlantic is 12,774 (CV=0.57). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Table 1. Summary of abundance estimates for both undifferentiated spotted dolphins (1995), and differentiated pantropical spotted dolphins (1998). 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 1995	Virginia to Gulf of St. Lawrence	4,772[1]	1.27
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	343[2]	1.03
Jul-Aug 1998	Florida to Maryland	12,774[2]	0.57
Jul-Aug 1998	Gulf of St. Lawrence to Florida (COMBINED)	13,117[3]	0.56

[1] Because of uncertain species identification in the 1995 survey, all spotted dolphins were lumped together.
[2] This represents the first estimates for pantropical spotted dolphin.
[3] This represents the combined estimates for both regions.

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 13,117 (CV=0.56). The minimum population estimate for pantropical spotted dolphins is 8,450 (CV=0.56).

Current Population Trend

There are insufficient data to determine the population trends for this species, because prior to 1998 spotted dolphins (*Stenella* spp) 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 the pantropical spotted dolphins is 8,450 (CV=0.56). 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 dolphins is 84.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY
Total annual estimated average fishery-related mortality or serious injury to this stock during 1994-1998 was 7.8 undifferentiated spotted dolphins (*Stenella* sp.) CV=0.01; Table 2).

Fisheries Information
No spotted dolphin mortalities were observed in 1977-1991 foreign fishing activities. Data on current incidental takes in USA fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fisheries information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Sea Sampling Observer Program was initiated in 1989 and since that year several fisheries have been covered by the program. In late 1992 and in 1993, the SEFSC provided observer coverage of pelagic longline vessels fishing off the Grand Banks (Tail of the Banks) and provides observer coverage of vessels fishing south of Cape Hatteras. Total fishery-related mortality and serious injury cannot be estimated separately for the two species of spotted dolphins in the USA Atlantic Exclusive Economic Zone (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.

Bycatch has 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 multispecies 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).

Pelagic Drift Gillnet
The estimated total number of hauls in the pelagic drift gillnet fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced. The estimated number of hauls in 1991, 1992, 1993, 1994, 1995, 1996, and 1998 were 233, 243, 232, 197, 164, 149, 113 respectively. In 1996 and 1997, NMFS issued management regulations which prohibited the operation of this fishery in 1997. Further, in January 1999 NMFS issued a Final Rule to prohibit the use of driftnets (*i.e.*, permanent closure) in the North Atlantic swordfish fishery (50 CFR Part 630). Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. Since 1994, between 10 and 13 vessels have participated in the fishery (Table 2). Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, 40% in 1992, 42% in 1993, 87% in 1994, 99% in 1995, 64% in 1996, and 99% 1998. Effort was concentrated along the southern edge of Georges Bank and off Cape Hatteras. Examination of the species composition of the catch and locations of the fishery throughout the year, suggested that the pelagic drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total bycatch, from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual bycatch for 1994 and 1995 were estimated from the sum of the observed caught and the product of the average bycatch per haul and the number of unobserved hauls as recorded in self-reported fisheries information. Variances were estimated using bootstrap re-sampling techniques. Forty-nine 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 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), NA in 1997, and 0 in 1998; average annual mortality and serious injury during 1994-1998 was 7.8 (0.01) (Table 2).

Pelagic Longline

The pelagic longline fishery operates in the USA Atlantic (including Caribbean) and Gulf of Mexico EEZ (SEFSC unpublished data). 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. This fishery has been monitored with about 5% observer coverage, in terms of trips observed, since 1992. Total effort, excluding the Gulf of Mexico, for the pelagic longline fishery, based on mandatory self-reported fisheries information, was 11,279 sets in 1991, 9,869 sets in 1992, 9,862 sets in 1993, 9,481 sets in 1994, 10,129 sets in 1995, 9,885 sets in 1996, 8,023 sets in 1997, and 6,675 sets in 1998 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung, 1999a). Since 1992, this fishery has been monitored with about 5% observer coverage, in terms of trips observed, within every statistical reporting area within the EEZ and beyond. Off the USA Atlantic coast, the fishery has been observed from January to March off Cape Hatteras, in May and June in the entire mid-Atlantic, and in July through December in the mid-Atlantic Bight and off Nova Scotia. The 1994-1998, estimated take was based on a revised analysis of the observed incidental take and self-reported incidental take and effort data, and replace previous estimates for the 1992-1993 and 1994-1995 periods (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999b). Further, Yeung (1999b), revised the 1992-1997 fishery mortality estimates in Johnson *et al.* (1999) to include seriously injured animals. The 1998 bycatch estimates were from Yeung (1999a). Most of the estimated marine mammal bycatch was from EEZ waters between South Carolina and Cape Cod (Johnson *et al.* 1999). Excluding the Gulf of Mexico where one animal was hooked and released alive (Appendix 1), no pantropical spotted dolphin bycatches were observed for 1992-1998.

Table 2. Summary of the incidental mortality of undifferentiated spotted dolphins (*Stenella* 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 mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).

Fishery	Years	Vessels	Data Type [1]	Observed Serious Injury	Observer Coverage [2]	Observed Mortality	Estimated Mortality [5]	Estimated CVs	Mean Annual Mortality
Pelagic[6] Drift Gillnet	94-98	1994=11[3] 1995=12 1996=10 1998=13	Obs. Data Logbook	0, 0, 0, 0, 0	.87, .99, .64, NA, .99	29, 0, 2, NA, 0	29, 0, 2[4], NA, 0	.01, 0, 0, NA, 0	7.8 (0.01)
TOTAL									7.8 (0.01)

[1] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Science Center (NEFSC) Sea Sampling Program. Mandatory logbook (Logbook) data are used to measure total effort for the pelagic drift gillnet fishery, and these data are collected at the Southeast Fisheries Science Center (SEFSC).

[2] The observer coverage for the pelagic drift gillnet and pair trawl fishery is measured in terms of sets, and the longline fishery is in trips.

[3] 1994, 1995, 1996 and 1998 shown, other years not available on an annual basis.

[4] Estimates were based on two seasons. The two observed takes were during the winter season when observer coverage was 100%.

[5] Annual mortality estimates include animals seriously injured and released alive.

[6] The fishery did not operate in 1997; the average annual mortality is based on the number of years (4; 1994-1998 that the fishery operated.

Other Mortality

From 1995-1998, 15 pantropical spotted dolphins were stranded between North Carolina and Florida (NMFS unpublished data). The 15 mortalities includes the 1996 mass stranding of 11 animals in Florida (NMFS unpublished data).

STATUS OF STOCK

The status of pantropical spotted dolphins, relative to OSP in the USA 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, 73 pp.

Buckland, S. T., D. R. Anderson, K. P. Burnham and J. L. Laake. 1993. Distance sampling: estimating abundance of biological populations. Chapman and Hall, New York, NY, 442 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.

Cramer, J. 1994. Large pelagic logbook newsletter - 1993. NOAA Tech. Mem. NMFS-SEFSC-352, 19 pp.

Johnson, D. R., C. A. Brown, and C. Yeung. 1999. Estimates of marine mammal and marine turtle catch by the U.S. Atlantic pelagic longline fleet in 1992-1997. SEFSC PRD-98/99-03. 68 pp.

Laake, J. L., S. T. Buckland, D. R. Anderson and K. P. Burnham. 1993. DISTANCE user's guide, V2.0. Colorado Cooperative Fish & Wildlife Research Unit, Colorado State University, Ft. Collins, Colorado, 72 pp.

Mullin, K. D. (in review). Abundance and distribution of cetaceans in the southern U.S. Atlantic Ocean during summer 1998. *Fish. Bull., U.S.*

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.

Northridge, S. 1996. Estimation of cetacean mortality in the U.S. Atlantic swordfish and tuna drift gillnet and pair trawl fisheries. Final report to the Northeast Fisheries Science Center, Contract No. 40ENNF500160.

Palka, D. 1995. Abundance estimate of the Gulf of Maine harbor porpoise. Rep. int Whal. Commn. Special Issue 16:27-50.

Palka, D. 1996. Update on abundance of Gulf of Maine/Bay of Fundy harbor porpoises. NOAA/NMFS/NEFSC. Ref. Doc. 96-04; 37p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026.

Palka, D., G. Waring, and D. Potter. (in review). Abundances of cetaceans and sea turtles in the northwest Atlantic during summer 1995 and 1998. *Fish. Bull., U.S.*

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. Mammal Sci. 3(2):99-170.

Perrin, W. F., D. K. Caldwell, and M. C. Caldwell. 1994. Atlantic spotted dolphin. Pages 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.

Perrin, W. F. and A. A. Hohn. 1994. Pantropical spotted dolphin *Stenella attenuata*. Pages 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.

Scott, G. P. and C. A. Brown. 1997. Estimates of marine mammal and marine turtle catch by the U.S. Atlantic pelagic longline fleet in 1994-1995. Miami Laboratory Contribution MIA-96/97-28

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-012, 93 pp.

Yeung, C. 1999a. Estimates of marine mammal and marine turtle bycatch by the U.S. Atlantic pelagic longline fleet in 1998. NOAA Technical Memorandum NMFS-SEFSC-430, 26 pp.

Yeung, C. 1999b. Revised Mortality Estimates of Marine Mammal Bycatch in 1992-1997 based on Serious Injury Guidelines. NOAA Technical Memorandum NMFS-SEFSC-429, 23 pp.