

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 100m depth contour. The species inhabits waters from central West Greenland to North Carolina (about 35°N) and perhaps as far east as 43°W (Evans 1987). 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 well-documented unit in the southern Gulf of Maine and a Gulf of St. Lawrence population comes from a hiatus of summer sightings along the Atlantic side of Nova Scotia. This has been reported in Gaskin (1992), is evident in Smithsonian stranding records, and was seen during abundance surveys conducted in the summers of 1995 and 1999 that covered waters from Virginia to the entrance of the Gulf of St. Lawrence. 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.

The Gulf of Maine stock of white-sided dolphins is most common in continental shelf waters from Hudson Canyon (approximately 39°N) north through Georges Bank, and in the Gulf of Maine to the 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), and even lower numbers are 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, have been seen at all times of the year but at low densities. The Virginia and North Carolina observations appear to represent the southern extent of the species range.

Prior to the 1970's, 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 1970's, 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).

POPULATION SIZE

The total number of white-sided dolphins along the eastern U.S. and Canadian Atlantic coast is unknown, although five 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; and 5) July-August 1999 (Figure 1; Table 1).

An abundance of 28,600 white-sided dolphins (CV=0.21) 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).

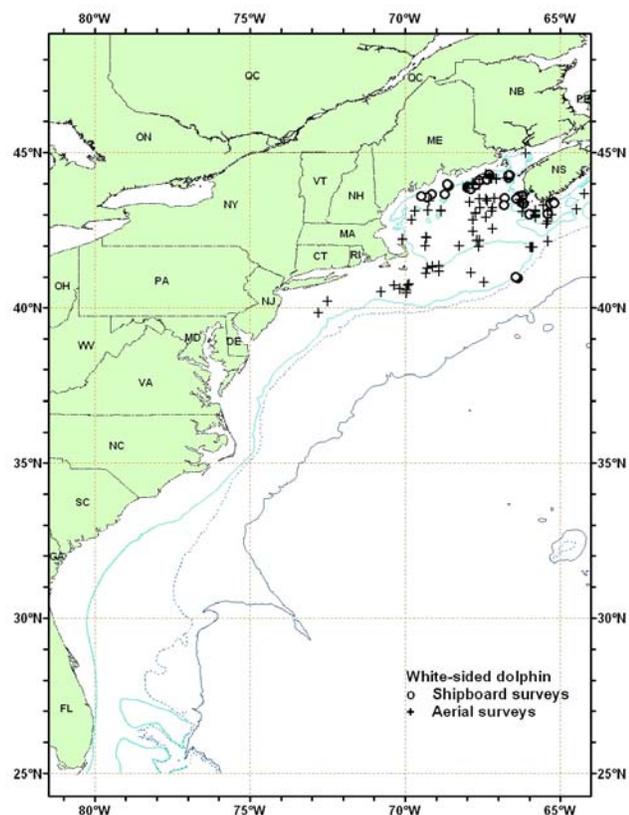


Figure 1. Distribution of white-sided dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers in 1998, 1999, and 2004. Isobaths are the 100m, 1000m, and 4000m depth contours.

An abundance of 20,400 (CV=0.63) white-sided dolphins was estimated from two shipboard line transect surveys conducted during July to September 1991 and 1992 in the northern Gulf of Maine-lower Bay of Fundy region (Palka *et al.* 1997). This population size is a weighted-average of the 1991 and 1992 estimates, where each annual estimate was weighted by the inverse of its variance.

An abundance of 729 (CV=0.47) white-sided dolphins was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000 m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (NMFS 1993).

An abundance of 27,200 (CV=0.43) white-sided 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 (Palka, Unpubl. Ms.). Total track line length was 32,600km. The ships covered waters between the 50 and 1000 fathom contours, 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 line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 51,640 (CV=0.38) white-sided dolphins was estimated from a 28 July to 31 August 1999 line-transect sighting survey conducted from a ship and an airplane covering waters from Georges Bank to the mouth of the Gulf of St. Lawrence (Table 1; Figure 1; D. Palka, Unpubl Ms.). Total track line length was 8,212 km. Using methods similar to that used in the above 1995 survey, 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 $g(0)$ (Palka 2000). The 1999 estimate is larger than the 1995 estimate due to, at least in part, the fact that the 1999 survey covered the upper Bay of Fundy and the northern edge of Georges Bank for the first time and white-sided dolphins were seen in both areas.

Kingsley and Reeves (1998) estimated that there were 11,740 (CV=0.47) white-sided dolphins in the Gulf of St. Lawrence during 1995 and 560 (CV=0.89) white-sided dolphins in the northern Gulf of St. Lawrence during 1996. It is assumed these estimates apply to the Gulf of St. Lawrence stock. During the 1995 survey, 8,427km of track lines were flown in an area of 221,949km² during August and September. During the 1996 survey, 3,993km of track lines were flown in an area of 94,665km² during July and August. Data were analyzed using Quenouille's jackknife bias reduction procedure on line transect methods that model the left-truncated sighting curve. These estimates were uncorrected for visibility biases, such as $g(0)$.

The best available current abundance estimate for white-sided dolphins in the Gulf of Maine stock is 51,640 (CV=0.38) as estimated from the July to August 1999 line transect survey because this survey is recent and provided the most complete coverage of the known habitat.

Table 1. Summary of recent abundance estimates for western North Atlantic 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
Gulf of Maine stock			
Jul-Aug 1999	Georges Bank to mouth of Gulf of St. Lawrence	51,640	0.38

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 Gulf of Maine stock of white-sided dolphins is 51,640 (CV=0.38). The minimum population estimate for these white-sided dolphins is 37,904.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: 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 110cm; length at sexual maturity is 230-240cm for males, and 201-222cm for females; age at sexual maturity is 8-9 years for males and 6-8 years for females; mean adult length is 250cm for males and 224cm 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 37,904. 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 0.48 because this stock is of unknown status and the CV of the mortality estimate is between 0.3 and 0.6. PBR for the Gulf of Maine stock of the western North Atlantic white-sided dolphin is 364.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Recently, within U.S. waters, white-sided dolphins have been observed caught in the Northeast sink gillnet, North Atlantic bottom trawl, and the Gulf of Maine/Georges Bank herring trawl TALFF fisheries (Table 2). Estimated average annual fishery-related mortality and serious injury to the Gulf of Maine stock of the western North Atlantic white-sided dolphin from these U.S. fisheries during 1999-2003 was 38 (CV=0.39) dolphins per year plus a pending estimate from the North Atlantic trawl fisheries.

Earlier Interactions

In the past, incidental takes of white-sided dolphins have been recorded in the Atlantic foreign mackerel and pelagic drift gillnet, Mid-Atlantic coastal gillnet and southern New England/Mid-Atlantic squid, mackerel, butterfish trawl fisheries. Fisheries information is reported in Appendix III.

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 fishing operations in which U.S. captains transfer their catches to foreign processing vessels.

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 to 1998. There was no fishery during 1997.

The Mid-Atlantic coastal 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. During 2002, the overall observer coverage was lower than usual, 1% over the entire coast, where 65% of those trips were off of Virginia and most of the rest of the area was not sampled at all. Thus, the low coverage was mostly concentrated in one time and area. In conclusion, a bycatch estimate from the unsurveyed areas cannot be confidently estimated.

Because of spatial and temporal differences in the harvesting of *Illex* and *Loligo* squid, and Atlantic mackerel, each of these sub-fisheries in the Southern New England/Mid-Atlantic squid, mackerel, butterfish trawl fisheries were analyzed separately. No white-sided dolphin takes have been observed taken incidental to *Illex* and *Loligo* squid fishing operations since 1996. No incidental takes of white-sided dolphin were observed in the Atlantic mackerel JV fishery when it was observed in 1998. The U.S. domestic fishery for Atlantic mackerel occurs primarily in the Southern New England and Mid-Atlantic waters between the months of January and May. One white-sided dolphin incidental take was observed in 1997 and none since then. The estimated mortality in 1997 was 161 (CV=1.58) animals.

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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 2003 there were 48 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 pinged 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 1997a), 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, and 31 (0.93) in 2003. Average annual estimated fishery-related mortality during 1999-2003 was 36 white-sided dolphins per year (0.39) (Table 2).

North Atlantic Bottom Trawl

The fishery is active in New England waters in all seasons. One moderately decomposed dolphin was brought up during a monkfish trawl in April 2001 east of Cape Cod. This moderately decomposed animal could not have been killed during this haul because the haul duration was only 4.6 hours. Three mortalities were documented between 1991 and 2001 in the North Atlantic bottom trawl fishery; 1 during 1992 and 2 during 1994. The 1 white-sided dolphin taken in 1992 was in a haul that was composed of 43% cod, 20% silver hake and 17% pollock. One of the 1994 takes was in a haul that was composed of 42% white hake, 19% pollock and 16% monkfish. The other 1994 take was in a haul that kept seven species of which none were dominant. One white-sided dolphin was observed taken in the Gulf Maine region during 2002 and 14 during 2003. The expanded bycatch estimate is pending. In 2002, there was one take reported through the Marine Mammal Authorization Program (MMAP) that was taken in a North Atlantic bottom trawl haul. The estimated fishery-related mortality in 1992 was 110 (CV=0.97), in 1994 it was 182 (CV=0.71) (Bisack 1997b), in 2002 and 2003 it was not yet been calculated, and it was 0 in other years. The average annual estimate fishery-related mortality during 1999 to 2003 is pending.

Northeast Atlantic (Gulf of Maine/Georges Bank) Herring Fishery

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) (Table 2). The total mortality attributed to the Atlantic herring mid-water trawl fishery in 2001 was 2 animals (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	Vessels	Data Type	Observer Coverage ²	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet	99-03	1993=349 1998=301	Obs. Data Weighout Trip Logbook	.06, .06, .04, .02, .03	4 ³ , 1 ³ , 1 ³ , 1 ³ , 1 ³	69 ³ , 26 ³ , 26 ³ , 30 ³ , 31 ³	.70, 1.00, 1.00, .74, .93	36 (0.39)
North Atlantic Bottom Trawl	99-03	TBD	Obs. Data Weighout	.003, .004, .004, .021, TBD	0, 0, 0, 1, 14	0, 0, 0, TBD ⁴ , TBD ⁴	0, 0, 0, TBD ⁴ , TBD ⁴	TBD ⁴
GOM/GB Herring Trawl-TALFF	2001	2 ⁵	Obs. Data	1.00 ⁵	2	2	0	2 (0)
Total								38 (0.39)

¹ Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Fisheries Science Center (NEFSC) Sea Sampling Program. NEFSC collects landings data (Weighout) that are used as a measure of total effort. Mandatory Vessel Trip Report (VTR) (Trip Logbook) data are used to determine the spatial distribution of fishing effort in the sink gillnet fishery.

² Observer coverage for the Northeast sink gillnet is measured in metric tons of fish landed and both trawl fisheries are measured in trips.

³ 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 and 2002, respectively, there were 2, 1, 1 and 1 observed white-sided dolphins taken on pingered trips. No takes were observed on pinger trips during 1995, 1996, 1998 and 2000.

⁴ TBD = To Be Determined. Estimating mortality attributed to the North Atlantic bottom trawl fishery is in progress.

⁵ There were two foreign vessels that harvested Atlantic Herring in the U.S. fishery under a TALFF quota. During TALFF fishing operations all nets fished by the foreign vessel are observed.

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 between 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 (43° 10'N 53° 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.

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.

Mass strandings involving up to a hundred or more animals at one time are common for this species. From 1968 to 1995, 349 Atlantic white-sided dolphins were known to have stranded on the New England coast (Hain and Waring 1994; Smithsonian stranding records 1996). 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.

White-sided dolphin stranding records from 1997 to 2003 that are in the NMFS/NE Regional Office strandings and entanglement database have been reviewed, updated, and reported in Table 3. Cause of death was investigated and it was determined that the documented human interaction were as follows: 1 animal possibly killed by a boat collision off Maine during 2001; 2 animals with indications of fishery interactions found in March 2002 in Massachusetts; and 1 animal with indications of fishery interactions found in May 2002 in Virginia (Table 3).

Mass strandings in Massachusetts occur frequently (Table 3). There were 80 animals in a mass stranding near Wellfleet, Massachusetts, during the week of 29 January to 3 February 1998. Of these, 2 were released alive. Of the 4 found in Massachusetts during the November 1998 mass stranding, 1 was released alive. Fifty-three animals stranded in Wellfleet, Massachusetts during 19-24 March 1999. During 1999, of the 70 strandings, 38 were found alive, and 3 of these animals were released alive. During 2000, 5 were found alive (3 in April and 2 in August), and the 2 in August were released alive. During 2002, there were mass strandings in March and August, of which a few were released alive. During 2003 in Massachusetts 36 white-sided dolphins were involved in mass strandings in January, April and November, of which 25 were found alive.

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 170km 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 (< 200cm), 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 2004 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), 6 in November 2002 (4 were released alive), 0 in 2003, and 19-24 in 2004 (15-20 in October (some (unspecified) were released alive) and 4 in November were released alive).

Table 3. Summary of number of stranded white-sided dolphins during January 1, 1999 to December 31, 2003, by year and area within U.S. and Canada.						
Area						Total
	1999	2000	2001	2002	2003	
Maine ^b	1		2	4	2	9
New Hampshire						0
Massachusetts ^{a,b}	65	24	16	53	59	217
Rhode Island				2		2
Connecticut					1	1
New York				1	2	3
New Jersey	3			1	1	5
Delaware						0
Maryland						0
Virginia ^b	1			1		2
North Carolina					1	1
TOTAL US	70	24	18	62	66	240
Nova Scotia	0	0	3	6	0	9
GRAND TOTAL	70	24	21	68	66	249
<p>^a Records of mass strandings in Massachusetts are: March 1999 - 53 animals; April 2000 - 5 animals; August 2000 - 11 animals; April 2001 - 6 animals; March 2002 - 31 animals, of which 7 were released alive; August 2002 - 3 animals, of which 1 was released alive; January 2003 - 4 animals; April 2003 - 28 animals; November 2003 - 4 animals.</p> <p>^b Strandings that appear to involve a human interaction are: 1 animal from Maine in 2001 that was a possible boat collision; 1 animal from Virginia in May 2002 had signs of fishery interaction; and 2 animals from Massachusetts in March 2002 had signs of fishery interactions.</p>						

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. There are insufficient data to determine population trends for this species. The total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This is a non-strategic stock because estimated average annual fishery-related mortality and serious injury does not exceed PBR.

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.
- Bisack, K. D. 1997a. Harbor porpoise bycatch estimates in the New England multispecies sink gillnet fishery: 1994 and 1995. Rep. Int. Whal. Comm. 47: 705-14.
- Bisack, K. D. 1997b. Marine mammal bycatch estimates and their sampling distributions in the U.S. New England sink gillnet, pair trawl, Atlantic pelagic drift gillnet and North Atlantic bottom trawl fisheries - 1994 to 1996. NOAA,

- NMFS, NEFSC. Woods Hole, MA. Working paper SC/49/SM35 submitted to the IWC Scientific Committee meeting in Bournemouth, UK, Aug/Sept 1997.
- 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.
- Evans, P. G. H. 1987. The natural history of whales and dolphins. Facts on File Publications, New York, 343 pp.
- Gaskin, D. E. 1992. Status of Atlantic white-sided dolphin, *Lagenorhynchus acutus*, in Canada. Can. J. Zool. 70: 64-72.
- Hain, J. H. W. and G. T. Waring. 1994. Status of and human effects upon marine mammals. Pages. 9-20 *In*: R. W. Langton, J. B. Pearce, and J.A. Gibson (eds.). Selected living resources, habitat conditions, and human perturbations of the Gulf of Maine: Environmental and ecological considerations for fishery managements. NOAA Tech. Memo. NMFS-NE-106. [Available from: NMFS, Northeast Fisheries Science Center, 166 Water St., Woods Hole, MA 02543].
- Hooker, S. K., R. W. Baird and M. A. Showell. 1997. Cetacean strandings and bycatches in Nova Scotia, Eastern Canada, 1991-1996. Meeting document SC/49/O5 submitted to the 1997 International Whaling Commission meeting in Bournemouth, UK.
- Katona, S. K., V. Rough and D. T. Richardson. 1993. A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland. Smithsonian Institution Press. Washington, DC. 316 pp.
- Kenney, R. D., P. M. Payne, D. W. Heinemann and H. E. Winn. 1996. Shifts in Northeast shelf cetacean distributions relative to trends in Gulf of Maine/Georges Bank finfish abundance. Pp. 169-196 *In*: K. Sherman, N.A. Jaworski and T. Smada (eds.). The northeast shelf ecosystem: assessment, sustainability, and management. Blackwell Science, Cambridge, MA 02142, USA.
- Kingsley, M. C. S. and R. R. Reeves. 1998. Aerial surveys of cetaceans in the Gulf of St. Lawrence in 1995 and 1996. Can. J. Zool. 76:1529-1550.
- Lucas, Z. N. and S. K. Hooker. 2000. Cetacean strandings on Sable Island, Nova Scotia, 1970-1998. Can. J. Zool. 78(1): 46-61.
- NMFS [National Marine Fisheries Service]. 1993. Cruise results, NOAA ship DELAWARE II, Cruise No. DEL 93-06, Marine Mammal Survey. 5 pp. [Available from: NMFS, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543.]
- Northridge, S., M. Tasker, A. Webb, K. Camphuysen and M. Leopold. 1997. White-beaked *Lagenorhynchus albirostris* and Atlantic white-sided dolphin *L. acutus* distributions in northwest European and U.S. North Atlantic waters. Rep. Int. Whal. Commn. 47:797-805.
- Palka, D. 2000. Abundance of the Gulf of Maine/Bay of Fundy harbor porpoise based on shipboard and aerial surveys during 1999. NOAA/NMFS/NEFSC Ref. Doc. 00-07. 29 pp. [Available from: NMFS, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543.]
- 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: NMFS, Northeast Fisheries Science Center, 166 Water Street, Woods Hole, MA 02543.]
- 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.
- Palka, D., A. Read and C. Potter. 1997. Summary of knowledge of white-sided dolphins (*Lagenorhynchus acutus*) from the U.S. and Canadian North Atlantic waters. Rep. Int. Whal. Commn. 47: 729-34.
- Payne, M. and D. W. Heinemann. 1990. A distributional assessment of cetaceans in the shelf and shelf edge waters of the northeastern United States based on aerial and shipboard surveys, 1978-1988. Report to NMFS. 108p. [Available from National Marine Fisheries Science Center, 166 Water St., Woods Hole, MA 02543.]
- Read, A. J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. Rep. Int. Whal. Commn., Special Issue 15: 133-147.
- Reeves, R. R., C. Smeenk, R. L. Brownell, Jr. and C. C. Kinze. 1999. Atlantic white-sided dolphin *Lagenorhynchus acutus* (Gray, 1828). Pp. 31-56 *In*: S. H. Ridgway and Sir R. Harrison (eds.) Handbook of Marine Mammals. Volume 6: The Second Book of Dolphins and the Porpoises. Academic Press, Boston.
- Sergeant, D. E., D. J. St. Aubin and J. R. Geraci. 1980. Life history and northwest Atlantic status of the Atlantic white-sided dolphin, *Lagenorhynchus acutus*. Cetology 37: 1-12.
- 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.
- Waring, G. T., P. Gerrior, P. M. Payne, B. L. Parry and J. R. Nicolas. 1990. Incidental take of marine mammals in foreign fishery activities off the northeast United States, 1977-1988. Fish. Bull., U.S. 88(2): 347-360.