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 on continental shelf waters to the 100 m depth contour. The species inhabits waters from central west Greenland to North Carolina (about 35°N) and perhaps as far east as 43º W (Evans 1987). Distribution of sightings, strandings and incidental takes suggests the possibly existence of three stocks units: a Gulf of Maine, Gulf of St. Lawrence, and a Labrador Sea stock (Palka *et al.*, in press). No genetic studies have been conducted to test this proposed population structure, although some samples are available to initiate such a study (about 25 specimens). 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 an abundance survey conducted in summer 1995 that covered waters from Virginia to the entrance of the Gulf of St. Lawrence (Palka and Waring, in prep.). White-sided dolphins were seen frequently in eastern Gulf of Maine waters and in waters at the mouth of the Gulf of St. Lawrence, but only one sighting was recorded in the waters between these two regions.

The Gulf of Maine stock of white-sided dolphins are 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. During January to April, 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. From June through September, large numbers of white-sided dolphins are found from Georges Bank to 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). From January to May, fewer dolphins are found in the southern Gulf of Maine and Georges Bank areas and a few strandings have been collected on beaches of Virginia and North Carolina. Sightings south of Georges Bank, and around Hudson Canyon, have been seen at all times of the year but at very low densities. These southern 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 of been a result of the increase in sand lance in these continental shelf waters (Katona *et al.* 1993; Kenny *et al.* 1996).

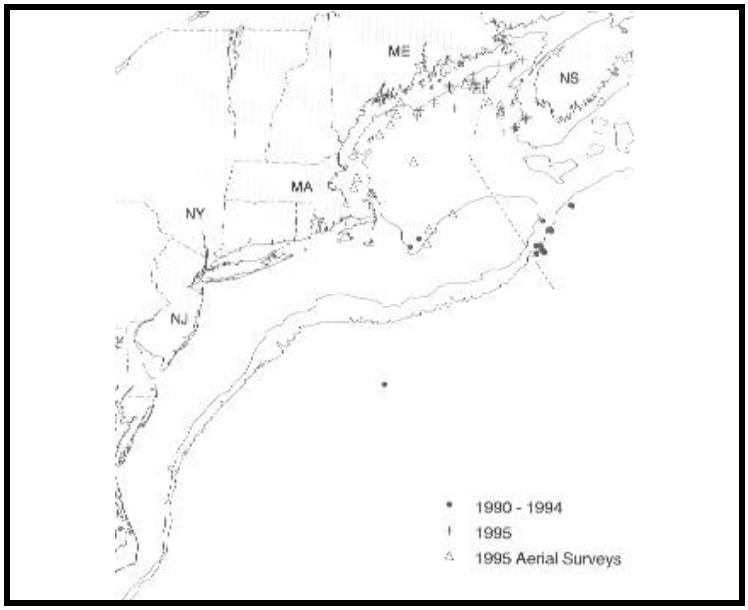

Figure 1. *Distribution of white-sided dolphin sightings from NEFSC shipboard and aerial surveys during the summer in 1990-1995. Isobaths are at 100 m and 1,000 m.*

POPULATION SIZE

The total number of white-sided dolphins along the eastern U.S. and Canadian Atlantic coast is unknown, although four estimates from select regions are available from spring, summer and autumn 1978-82, July-September 1991-92, and July-September 1995 (Table 1; Figure 1).

A population size 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 (Table 1; CeTAP 1982). The estimate was based on an inverse variance weighted pooling of spring, summer and autumn data. An average of these seasons

were chosen because the greatest proportion of the population off the northeast U.S. coast appeared in the study area during these seasons. This estimate does not include a correction for dive-time or g(0), the probability of detecting an animal group on the track line. This estimate may not reflect the current true population size because of its old age, and it was estimated just after cessation of extensive foreign fishing operations in the region.

A population size 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. 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. The data were collected during surveys designed to estimate abundance of harbor porpoises (Palka 1995). Two independent teams of observers on the same ship surveyed using naked eye in non-closing mode. Using the product integral analytical method (Palka 1995) and DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993) the abundance includes an estimate of school size-bias, if applicable, an estimate of g(0), probability of detecting a group on the track line, but no correction for dive-time. Variability was estimated using bootstrap resampling.

A population size 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 2,000m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (Table 1; Anon. 1993). Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school size-bias, if applicable, but do not include corrections for g(0) or dive-time. Variability was estimated using bootstrap resampling techniques.

A population size 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 (Table 1; Palka and Waring, in prep.). Total track line length was 32,600 km (17,600 nmi). The ships covered waters between the 50 and 1000 fathom 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 contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom contour line. Shipboard data were collected using a two independent sighting team procedure and were analyzed using the product integral method (Palka 1995) and DISTANCE (Buckland *et al.* 1993). Shipboard estimates were corrected for g(0) and, if applicable, also for school size-bias. Standard aerial sighting procedures with two bubble windows and one belly window observer were used during the aerial survey. An estimate of g(0) was not made for the aerial portion of the survey. Estimates do not include corrections for dive-time. Variability was estimated using bootstrap resampling techniques.

There are no published abundance estimates for this species in Canadian waters which lie farther north or east of the above surveys (Gaskin 1992).

The best available current abundance estimate for white-sided dolphins is 27,200 (CV=0.43) for U.S. waters as estimated from the July to September 1995 line transect survey (Palka and Waring, in prep.) because this survey is recent and provided the most complete coverage of the known habitat.

Table 1. Summary of 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
spring, summer & autumn 1978-82	Cape Hatteras, NC to Nova Scotia	28,600	0.21
Jul-Sep 1991-92	N. Gulf of Maine and Bay of Fundy	20,400	0.63
Jun-Jul 1993	Georges Bank to Scotian shelf, shelf edge only	729	0.47
Jul-Sep 1995	Virginia to Gulf of St. Lawrence	27,200	0.43

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 white-sided dolphins is 27,200 (CV=0.43). The minimum population estimate for the western North Atlantic white-sided dolphins is 19,196 (CV=0.43).

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 110 cm; length at sexual maturity is 230-240 cm for males, and 201-222 cm for females; age at sexual maturity is 8-9 years for males and 6-8 years for females; mean adult length is 250 cm for males and 224 cm for females (Evans 1987); and maximum reported age for males is 22 years and for females, 27 years (Sergeant *et al.* 1980).

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery" factor (Wade and Angliss 1997). The minimum population size is 19,196 (CV=0.43). The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor, which accounts for endangered, depleted, threatened, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because this stock is of unknown status. PBR for the western North Atlantic white-sided dolphin is 192.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

In the past, incidental takes of white-sided dolphins have been recorded in the New England and Bay of Fundy groundfish gillnet fisheries and the Atlantic foreign mackerel fishery. In the mid 1980's, during a University of Maine study, gillnet fishermen retained six carcasses for biological studies (Gilbert and Wynne 1987; Gaskin 1992). NMFS foreign fishery observers have 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 nine documented takes by U.S. vessels involved in joint-venture fishing operations in which U.S. captains transfer their catches to foreign processing vessels.

Recently, within U.S. waters, white-sided dolphins have been caught in the pelagic drift gillnet fishery, and the North Atlantic bottom trawl and New England multispecies sink gillnet fisheries (Table 2). During 1991 to 1995, two white-sided dolphins were observed taken in the Atlantic pelagic drift gillnet fishery, resulting in an estimated average annual mortality and serious injury of 0.9 white-sided dolphins (0.51). Three mortalities were documented between 1991 and 1995 in the North Atlantic bottom trawl fishery, resulting in an average annual estimate fishery-related mortality of 58.4 white-sided dolphins (CV = 0.57). Between 1990 and 1995 there were 33 mortalities observed in the New England multispecies sink gill fishery, resulting in an average annual estimated fishery-related mortality of 121 white-sided dolphins (CV = 0.24)

There is little information available which quantifies fishery interactions involving white-sided dolphins in Canadian waters. Two white-sided dolphins were reported caught in groundfish gillnets set in the Bay of Fundy during 1985 to 1989, and nine were taken in West Greenland between 1964 and 1966 in salmon drift nets (Gaskin 1992). Several (number not specified) were also taken in Newfoundland and Labrador groundfish gillnets in the 1960's. A few were taken in an experimental drift gillnet fishery for salmon off West Greenland which took place from 1965 to 1982 (Read 1994). More recent information on Canadian white-sided dolphin takes were not available.

Estimated average annual fishery-related mortality and serious injury to the western North Atlantic white-sided dolphin stock during 1990-1995 was 181 dolphins (CV = 0.25).

Fisheries Information

Data on current incidental takes in U.S. 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.

White-sided dolphin bycatch has been observed by NMFS Sea Samplers in the 1970-80's Atlantic foreign mackerel and joint-venture fisheries, and the more recent Atlantic pelagic drift gillnet, North Atlantic bottom trawl fisheries, and New England multispecies sink gillnet.

Prior to 1977, there was no documentation of marine mammal by-catch in distant-water fleet (DWF) activities off the northeast coast of the U.S. With implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA) in that year, an observer program was established which has recorded fishery data and information of incidental by-catch of marine mammals. DWF effort in the U.S. Atlantic Exclusive Economic Zone (EEZ) under MFCMA has been directed primarily towards Atlantic mackerel and squid. From 1977 through 1982, an average of 120 different foreign vessels per year (range 102-161) operated within the Atlantic coast EEZ. In 1982, there were 112 different foreign vessels; 16%, or 18, were Japanese tuna longline vessels operating along the U.S. east coast. This was the first year that the Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels. Between 1983 and 1991, the numbers of foreign vessels operating within the Atlantic coast EEZ each year were 67, 52, 62, 33, 27, 26, 14, 13, and 9, respectively. Between 1983 and 1988, the numbers of DWF vessels included 3, 5, 7, 6, 8, and 8, respectively, Japanese longline vessels. Observer coverage on DWF vessels was 25-35% during 1977-82, and increased to 58%, 86%, 95%, and 98%, respectively, in 1983-86; 100% observer coverage was maintained during 1987-91. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and for mackerel at the end of the 1991 season.

The estimated total number of hauls in the Atlantic 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 and 1995 were 233, 243, 232, 197 and 164 respectively. Fifty-nine different vessels participated in this fishery at one time or another between 1989 and 1993. In 1994 and 1995 there were 11 and 12 vessels, respectively, 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 and 99% in 1995. 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 drift gillnet fishery be stratified into two strata, a southern or winter stratum, and a northern or summer stratum. Estimates of the total by-catch, for each year from 1989 to 1993, were obtained using the aggregated (pooled 1989-1993) catch rates, by strata (Northridge 1996). Estimates of total annual by-catch 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 logbooks. Variances were estimated using bootstrap re-sampling techniques (Bisack, in prep.). Estimated annual fishery-related mortality and serious injury (CV in parentheses) was 4.4 in 1989 (.71), 6.8 in 1990 (.71), 0.9 in 1991 (.71), 0.8 in 1992 (.71), 2.7 in 1993 (0.17), 0 in 1994 and 0 in 1995. Estimated average annual mortality and serious injury during related to this fishery during 1991-1995 was 0.9 white-sided dolphins (0.22) (Table 2).

Vessels in the North Atlantic bottom trawl fishery, a Category III fishery under the MMPA, were observed in order to meet fishery management needs, rather than marine mammal management needs. An average of 970 (CV = 0.04) vessels (full and part time) participated annually in the fishery during 1989-1993. The fishery is active in New England in all seasons. Three mortalities were documented between 1991 and 1995 (Table 2). The one white-sided dolphin taken in 1992 was taken 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. The estimated fishery-related mortality from 1992

was 110 (CV = 0.97), from 1994 it was 182 (CV=0.71) and it was 0 in the other years (Bisack, in prep.). The average annual estimate fishery-related mortality during 1991-1995 was 58.4 white-sided dolphins (CV = 0.57) (Table 2).

There are approximately 349 vessels (full and part time) in the New England multispecies sink gillnet fishery (Walden 1996). Observer coverage in trips has been 1%, 6%, 7%, 5%, 7%, and 5% for years 1990 to 1995. The fishery has been observed in the Gulf of Maine and in Southern New England. There have been 33 mortalities observed in this fishery between 1990 and 1995. Estimated annual fishery-related mortalities (CV in parentheses) were 49 in 1991 (0.46), 154 in 1992 (0.35), 205 in 1993 (0.31), 240 in 1994 (0.51), and 80 in 1995 (1.16) (Bisack, in prep.). Average annual estimated fishery-related mortality during 1990-1995 was 121 white-sided dolphins (0.24) (Table 2). In January to March, the by-catch occurred in Massachusetts Bay, south of Cape Ann and west of Stellwagen Bank. From April to June, by-catch locations became more dispersed, from Casco Bay to Cape Ann, along the 30 fathom contour out to Jeffreys Ledge, with one take location near Cultivator Shoal and one in southern New England near Block Island. In July through September, incidental takes occurred from Frenchman's Bay to Massachusetts Bay. In inshore waters, the takes were aggregated while offshore takes were more dispersed. In October through December, takes were confined from Cape Elizabeth out to Jeffreys Ledge and south to Nantucket Sound.

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 [1]	Observer Coverage [2]	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
New England Multispecies Sink Gillnet	90-95	349	Obs. Data Weighout	.01, .06, .07, .05, .07, .05	0, 4, 9, 7,10[3], 2	0, 49, 154, 205, 240[3], 80	0, .46, .35, .31, .51, 1.16	121.3 (.24)
Pelagic Drift Gillnet	91-95	1994=11[4] 1995=12	Obs. Data Logbook	.20, .40, .42, .87, .99	0, 0, 2, 0, 0	0.9[5], 0.8, 2.7, 0, 0	.71, .71, 0.17, 0, 0	0.9 (.22)
North Atlantic Bottom Trawl	91-95	970	Obs. Data Weighout	.007, .006, .004, .004, .011[6]	0, 1, 0, 2, 0	0, 110, 0, 182, 0	0, .97, 0, .71, 0	58.4 (.57)
Total								180.6 (.25)

[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. NEFSC collects Weighout (Weighout) landings data, and total landings are used as a measure of total effort for the sink gillnet fishery. 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 sink gillnet fishery is measured in trips, the pelagic drift gillnet fishery is measured in sets, and the Atlantic bottom trawl fishery is in days fished.

[3] White-sided dolphins taken on observed pinger trips were added directly to the estimated total bycatch for that year. There was one observed white-sided dolphin take on a pinger trip in 1994, which was not included in the observed mortality.

[4] 1994 and 1995 shown, other years not available on an annual basis.

[5] For 1991-1993, pooled bycatch rates were used to estimate bycatch in months that had fishing effort but did not have observer coverage. This method is described in Northridge (1996).

[6] Observer coverage for the Atlantic bottom trawl fishery in 1995 is based on only January to May data.

Other Mortality

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 are 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 not all of the marine mammals which die or are seriously injured may 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.

Polychlorinated biphenyls (PCBs) and DDT, which have been found in moderate levels in the blubber (Gaskin 1985) are potential sources of human-caused mortality; however, the effect of the observed levels of pollutants is not known.

Among mature females in a mass stranding in Maine, 47% were infected with the nematode *Crassicauda grampicola* in the mammary glands. Geraci *et al.* (1978) suggested that the relatively high incidence and severity of lesions resulting from this parasitism could negatively affect reproductive performance of these animals.

STATUS OF STOCK

The status of white-sided dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. In Canada, the Cetacean Protection Regulations of 1982, promulgated under the Standing Fisheries Act, prohibit the catching or harassment of all cetacean species. 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 not a strategic stock because estimated average annual fishery-related mortality and serious injury does not exceed PBR and the white-sided dolphin is not listed as a threatened or endangered species under the ESA.

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