BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Western North Atlantic Offshore Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two hematologically and morphologically distinct bottlenose dolphin ecotypes (Duffield *et al*. 1983; Duffield 1986) which correspond to a shallow, warm water ecotype and a deep, cold water ecotype; both ecotypes have been shown to inhabit waters in the western North Atlantic Ocean (Hersh and Duffield 1990).

Bottlenose dolphins which had stranded alive in the western North Atlantic in areas with direct access to deep oceanic waters had hemoglobin profiles which matched that of the deep, cold water ecotype (Hersh and Duffield 1990). Hersh and Duffield (1990) also described morphological differences between the deep, cold water ecotype dolphins and dolphins with hematological profiles matching the shallow, warm water ecotype which had stranded in the Indian/Banana River in Florida. Based on the distribution of sightings during ship-based surveys (Figure 1) and survey personnel observations (NMFS unpublished data), the western North Atlantic offshore stock is believed to consist of bottlenose dolphins corresponding to the hematologically and morphologically distinct deep, cold water ecotype.

Extensive aerial surveys in 1979-1981 indicated that the stock extended along the entire continental shelf break from Georges Bank to Cape Hatteras during spring and summer (CeTAP 1982; Kenney 1990). The distribution of sightings contracted towards the south in the fall and the central portion of the survey area was almost devoid of sightings in the winter, although there were still sightings as far north as the southern edge of Georges Bank. The offshore stock is concentrated along the continental shelf break in waters of depths > 25 m and extends beyond the continental shelf into continental slope waters in lower concentration (Figure 1) consistent with Kenney 1990. No distribution or abundance data are available from Canadian waters. Dolphins with characteristics of the offshore type have been stranded as far south as the Florida Keys, but there are no abundance or distribution estimates available for this stock in U.S. Exclusive Economic Zone (EEZ) waters south of Cape Hatteras.

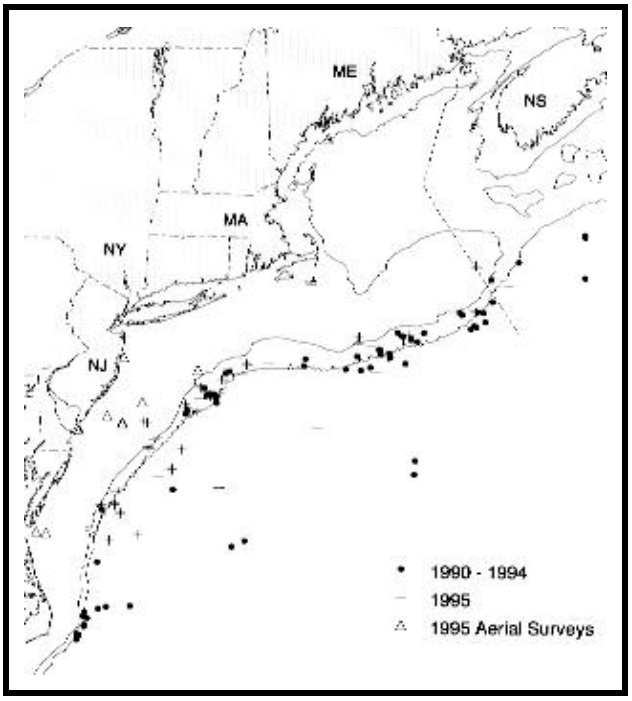

Figure 1. *Distribution of bottlenose dolphin sightings from NEFSC shipboard and aerial surveys during the summer in 1990-1995. Isobaths are at 100 m and 1,000 m.*

POPULATION SIZE

The total number of bottlenose dolphins off the Atlantic U.S. coast is unknown; however, six abundance estimates are available for portions of the northeastern U.S. Atlantic during fall of 1978-82, August 1990, June - July 1991, August-September 1991, June-July 1993, and July - September 1995 (Table 1 and Figure 1).

A population size of 7,696 offshore bottlenose dolphins (CV=0.58) 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 is based on fall data only because the greatest proportion of the population off the northeast U.S. coast appeared in the study area the fall. 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 high degree of uncertainty (e.g., large CV), its old age, and it was estimated just after cessation of extensive foreign fishing operations in the region.

A population size of 2,903 offshore bottlenose dolphins (CV=0.66) was estimated from an August 1990 shipboard line transect sighting survey, conducted principally along the Gulf Stream north wall between Cape Hatteras and Georges Bank (Table 1; Waring *et al.* 1992). Data were collected by one team that searched by naked eye and 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 9,106[1] offshore bottlenose dolphins (CV=0.34) was estimated from a June and July 1991 shipboard line transect sighting survey conducted primarily between the 200 and 2,000m isobaths from Cape Hatteras to Georges Bank (Table 1; Waring *et al.* 1992). Data were collected by one team that searched by naked eye and analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993). Estimates include school size-bias, if applicable, but no corrections for g(0) or dive-time. Variability was estimated using bootstrap resampling techniques.

A population size of 12,090 (CV=0.38) and 12,760 (CV=0.84) offshore bottlenose dolphins was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (Table 1; Anon. 1991). The study area included that covered in the CeTAP study plus several additional continental slope survey blocks. Due to weather and logistical constraints, several survey blocks south and east of Georges Bank were not surveyed. The data were analyzed using DISTANCE (Buckland *et al.* 1993; Laake *et al.* 1993), where the CV was estimated using the bootstrap option. The abundance estimates do not include g(0) and were not pooled over platforms because the inter-platform calibration analysis has not been conducted.

A population size of 716 offshore bottlenose dolphins (CV=0.44) 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 13,453 offshore bottlenose dolphins (CV=0.54) 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.

Although the 1990-1995 surveys did not sample the same areas or encompass the entire offshore bottlenose dolphin habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990-95 data suggest that, seasonally, at least several thousand bottlenose dolphins are occupying these waters; however, survey coverage to date is not judged adequate to provide a definitive estimate of bottlenose dolphin abundance in the western North Atlantic because of the limited scope of the shipboard surveys. The best available current abundance estimate for offshore bottlenose dolphins is 13,453 (CV=0.54) as estimated from the July to September 1995 line transect

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[1]In June 1997, a coding error was found in the 1991 shipboard data file which impacted the stratification component of the DISTANCE analysis. The revised value reflects this correction, it does not represent a new analysis of the 1991 survey data. This error occurred in the analysis of pilot whales, common dolphins, Risso's dolphins and offshore bottlenose dolphins. The revised numbers **have not** been reviewed by the Atlantic Scientific Review Group or the Atlantic Offshore Take Reduction Team. Details are contained in G. Waring, Memo to The Record, August 1997.

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 the western North Atlantic offshore bottlenose dolphin. 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
fall 1978-82	Cape Hatteras, NC to Nova Scotia	7,676	0.58
Aug 1990	Gulf Stream	2,903	0.66
Jun-Jul 1991	Cape Hatteras, NC to Georges Bank, shelf edge only	9,106	0.34
Aug-Sep 1991	Cape Hatteras, NC to Nova Scotia	12,090 and 12,760*	0.38 and 0.84*
Jun-Jul 1993	Georges Bank to Scotian shelf, shelf edge only	716	0.44
Jul-Sep 1995	Virginia to Gulf of St. Lawrence	13,453	0.54

* from data collected on the Twin Otter and AT-11, respectively.

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 offshore bottlenose dolphins is 13,453 (CV=0.54). The minimum population estimate for the western North Atlantic offshore bottlenose is 8,794 (CV=0.54).

Current Population Trend

The data are insufficient to determine population trends.

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 (Wade and Angliss 1997). The minimum population size for offshore bottlenose dolphins is 8,794 (CV=0.54). 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 the western North Atlantic offshore bottlenose dolphin is 88.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are no available estimates of human-caused mortality or serious injury except for estimates extrapolated from data obtained through NMFS fishery observer programs.

Estimated average annual fishery-related mortality or serious injury to this stock is 82 offshore bottlenose dolphins (CV = 0.27).

Fishery Information

There was no documentation of marine mammal mortality or serious injury in distant-water fleet (DWF) activities off the northeast coast of the U.S. prior to 1977. A fisheries observer program which recorded fishery data and information on incidental by-catch of marine mammals was established with implementation of the Magnuson Fisheries Conservation and Management Act (MFCMA) in 1977. DWF effort in the U.S. Atlantic EEZ under MFCMA was directed primarily towards Atlantic mackerel and squid. An average of 120 different foreign vessels per year (range 102-161) operated within the Atlantic coast EEZ from 1977 through 1982. In 1982, the first year that the NMFS Northeast Regional Observer Program assumed responsibility for observer coverage of the longline vessels, there were 112 different foreign vessels, eighteen (16%) of which were Japanese tuna longline vessels operating along the U.S. east coast. Between 1983 and 1991, the number of foreign fishing vessels operating within the U.S. Atlantic EEZ each year declined from 67 to nine. 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. From 1987-91, 100% observer coverage was maintained. Foreign fishing operations for squid ceased at the end of the 1986 fishing season and for mackerel at the end of the 1991 season. Observers in this program recorded nine bottlenose dolphin mortalities in foreign-fishing activities during 1977-1988 (Waring *et al*. 1990). Seven takes occurred in the mackerel fishery, and one bottlenose dolphin each was caught in both the squid and hake trawl fisheries.

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.

By-catch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic pair trawl, mid-Atlantic coastal sink gillnet, and North Atlantic bottom trawl fisheries, but no mortalities have documented in pelagic longline fishery.

Although there have been no reported mortalities of this stock by the pelagic longline fishery, one bottlenose dolphin was taken and released alive during 1993 in offshore waters outside of the U.S. EEZ (NMFS unpublished data). Vessels in this fishery 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 for the pelagic longline fishery (Atlantic, including the Caribbean), based on mandatory self-reported fisheries information, was 11,279 sets in 1991, 10,605 sets in 1992, and 11,538 in 1993 (Cramer 1994). The fishery has been observed nearly year round within every statistical reporting area within the EEZ and beyond.

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 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 1995 there were 11 vessels in the fishery (Table 2). Observer coverage, expressed as percent of sets observed, was 8% in 1989, 6% in 1990, 20% in 1991, to 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 pelagic 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, 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 self-reported fisheries information. Variances were estimated using bootstrap re-sampling techniques (Bisack, in prep.). Fifty-seven bottlenose dolphin mortalities have been observed between 1989 and 1995. Estimated bottlenose dolphin kills (CV in parentheses) extrapolated for each year were 72 in 1989 (0.18), 115 in 1990 (0.18), 26 in 1991 (0.15), 28 in 1992 (0.10), 22 in 1993 (0.13), 14 in 1994 (0.04), and 5 in 1995 (0). Mean annual estimated fishery-related mortality for this fishery in 1991-1995 was 18.8 bottlenose dolphins (CV=0.06) (Table 2).

Effort in the pelagic pair trawl fishery has increased during the period 1989 to 1993, from zero hauls in 1989 and 1990, to an estimated 171 hauls in 1991, and then to an estimated 536 hauls in 1992, 586 in 1993, 407 in 1994, and 440

in 1995, respectively. The fishery operated from August-November in 1991, from June-November in 1992, from June-October in 1993 (Northridge 1996), and from mid-summer to November in 1994 and 1995 (Bisack, in prep.). Sea sampling began in October 1992, and 48 sets (9% of the total) were sampled in that season, 102 hauls (17% of the total) were sampled in 1993. In 1994 and 1995, 52% and 55%, respectively, of the sets were observed. Nineteen vessels have operated in this fishery. The fishery extends from 35°N to 41°N, and from 69°W to 72°W. Approximately 50% of the total effort was within a one degree square at 39°N, 72°W, around Hudson Canyon. Examination of the locations and species composition of the by-catch, showed little seasonal change for the six months of operation and did not warrant any seasonal or areal stratification of this fishery (Northridge 1996). Thirty-three bottlenose dolphin mortalities were observed between 1991 and 1995. Estimated annual fishery-related mortality (CV in parentheses) was 13 dolphins in 1991 (0.52), 73 in 1992 (0.49), 85 in 1993 (0.41), 4 in 1994 (0.40) and 17 in 1995 (0.26). The 1992-1995 estimated mean annual bottlenose dolphin mortality attributable to this fishery is 45 (CV=0.28) (Table 2). Table 3 summarizes the number of animals released alive and classified as injured or non-injured. It also includes the ratio of observed to estimated mortalities for this fishery.

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 waters in all seasons. One bottlenose dolphin mortality was documented in 1991 and the total estimated mortality in this fishery in 1991 was 91 (CV=0.97) (Bisack, in prep.). The average fishery-related mortality attributable to this fishery between 1991-1995 was 18 bottlenose dolphins (CV = 0.97).

The mid-Atlantic mackerel and squid trawl fisheries were combined into the Atlantic squid, mackerel and butterfish trawl fishery in 1996. The fishery occurs along the U.S. mid-Atlantic continental shelf region between New Brunswick, Canada, and Cape Hatteras year around. The mackerel trawl fishery was classified as a Category II fishery since 1990 and the squid fishery was originally classified as a Category II fishery in 1990, but was reclassified as a Category III fishery in 1992. The combined fishery has been proposed for classification as a Category II fishery. Although there were reports of bottlenose dolphin mortalities in the foreign fishery during 1977-1988, there were no fishery-related mortalities of bottlenose dolphins reported in the self-reported fisheries information from the mackerel trawl fishery between 1990-1992.

Table 2. Summary of the incidental mortality of bottlenose dolphins (*Tursiops truncatus*) 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
Pelagic Drift Gillnet	91-95	1994=11[3] 1995=12	Obs. Data Logbook	.20, .40, .42, .87, .99	5, 12, 6, 12, 5	26, 28, 22, 13, 5.0[4]	.14, .10, .13, .05, 0	18.8 (.06)
Pelagic Pair Trawl	92-95	12	Obs. Data Logbook	.10, .18, .52, .54	4, 17, 3, 9	73, 85, 4.0, 17	.49, .41, .40, .26	44.8 (.28)
North Atlantic Bottom Trawl	91-95	970	Obs. Data Weighout	.007, .006, .004, .004, .011[5]	1, 0, 0, 0, 0	91, 0, 0, 0, 0	.97, 0, 0, 0, 0	18.2 (.97)
Mid-Atlantic Coastal Sink Gillnet Gillnet	93-95		Obs. Data	20, 221, 369	0, 1, 0			
TOTAL								81.8 (.27)

[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 coastal gillnet fishery and days fished are used as total effort for the North Atlantic bottom trawl 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 pelagic drift gillnet and pair trawl fishery is measured in terms of sets, and the North Atlantic bottom trawl fishery is in days fished. Assessments for the coastal gillnet fishery have not been completed. The number of trips sampled by the NEFSC Sea Sampling Program are reported here.

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

[4] One vessel was not observed and recorded 1 set in a 10 day trip in the SEFSC mandatory logbook. If you assume the vessel fished 1.4 sets per day as estimated from the 1995 SS data, the point estimate may increase by 0.42 animals. However, the SEFSC mandatory logbook data was taken at face value, and therefore it was assumed that 1 set was fished within this trip, and the point estimate would then increase by 0.03 animals.

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

Table 3. Summary of bottlenose dolphins (*Tursiops truncatus*) released alive, by commercial fishery, years sampled (Years), ratio of observed mortalities recorded by on-board observers to the estimated mortality (Ratio), the number of observed animals released alive and injured (Injured), and the number of observed animals released alive and uninjured (Uninjured)

Fishery	Years	Ratio	Injured	Uninjured
Pelagic Pair Trawl	92-95	4/73, 17/85, 3/4, 9/17	0, 0, 1 [1] , 0	0, 0, 0, 0

[1] Released alive, condition unknown.

Other Mortality

There are no other known sources of human-caused mortality affecting this stock.

STATUS OF STOCK

The status of this stock relative to OSP in the Atlantic EEZ is unknown. The western north Atlantic offshore bottlenose dolphin 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 the population trends for this species. This level 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. The status of this stock has been changed from strategic to non-strategic because the estimated annual fishery-related mortality and serious injury is below PBR.

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