

APPENDIX IV: Reports not updated in 2008

January 2002

BLUE WHALE (*Balaenoptera musculus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of the blue whale, *Balaenoptera musculus*, in the western North Atlantic generally extends from the Arctic to at least mid-latitude waters. Blue whales are most frequently sighted in the waters off eastern Canada, with the majority of recent records from the Gulf of St. Lawrence (Sears *et al.* 1987). The species was hunted around Newfoundland in the first half of the 20th century (Sergeant 1966). The present Canadian distribution, broadly described, is spring, summer, and fall in the Gulf of St. Lawrence, especially along the north shore from the St. Lawrence River estuary to the Strait of Belle Isle and off eastern Nova Scotia. The species occurs in winter off southern Newfoundland and also in summer in Davis Strait (Mansfield 1985). Individual identification has confirmed the movement of a blue whale between the Gulf of St. Lawrence and western Greenland (R. Sears and F. Larsen, unpublished data), although the extent of exchange between these two areas remains unknown. Similarly, a blue whale photographed by a NMFS large whale survey in August 1999 had previously been observed in the Gulf of St. Lawrence in 1985 (R. Sears and P. Clapham, unpublished data).

The blue whale is best considered as an occasional visitor in US Atlantic Exclusive Economic Zone (EEZ) waters, which may represent the current southern limit of its feeding range (CETAP 1982; Wenzel *et al.* 1988). All of the five sightings described in the foregoing two references were in August. Yochem and Leatherwood (1985) summarized records that suggested an occurrence of this species south to Florida and the Gulf of Mexico, although the actual southern limit of the species' range is unknown.

Using the U.S. Navy's SOSUS program, blue whales have been detected and tracked acoustically in much of the North Atlantic, including in subtropical waters north of the West Indies and in deep water east of the US Atlantic EEZ (Clark 1995). Most of the acoustic detections were around the Grand Banks area of Newfoundland and west of the British Isles. Sigurjónsson and Gunnlaugsson (1990) note that North Atlantic blue whales appear to have been depleted by commercial whaling to such an extent that they remain rare in some formerly important habitats, notably in the northern and northeastern North Atlantic.

POPULATION SIZE

Little is known about the population size of blue whales except for in the Gulf of St. Lawrence area. Here, 308 individuals have been catalogued (Sears *et al.* 1987), but the data were deemed to be unusable for abundance estimation (Hammond *et al.* 1990). Mitchell (1974) estimated that the blue whale population in the western North Atlantic may number only in the low hundreds. R. Sears (pers. comm.) suggests that no present evidence exists to refute this estimate.

Minimum Population Estimate

The 308 recognizable individuals from the Gulf of St. Lawrence area which were catalogued by Sears *et al.* (1987) is considered to be a minimum population estimate for the western North Atlantic stock.

Current Population Trend

There are insufficient data to determine population trends for this species. Off western and southwestern Iceland, an increasing trend of 4.9% a year was reported for the period 1969-1988 (Sigurjónsson and Gunnlaugsson 1990), although this estimate should be treated with caution given the effort biases underlying the sightings data on which it was based.

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 is 308. 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 0.10 because the blue whale is listed as endangered under the Endangered Species Act (ESA). However, the minimum population size figure given

above is now 14 years old and thus is not usable for the calculation of PBR (see Wade and Angliss 1997). Consequently, no PBR can be calculated for this stock because of lack of any data on current minimum population size.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are no confirmed records of mortality or serious injury to blue whales in the US Atlantic EEZ. However, in March 1998 a dead 20 m (66ft) male blue whale was brought into Rhode Island waters on the bow of a tanker. The cause of death was determined to be ship strike. Although it appears likely that the vessel concerned was responsible, the necropsy revealed some injuries that were difficult to explain in this context. The location of the strike was not determined; given the known rarity of blue whales in US Atlantic waters, and the vessel's port of origin (Antwerp), it seems reasonable to suppose that the whale died somewhere to the north of the US Atlantic EEZ.

However, this incident was used in calculating the total annual mortality rate of 0.2 used in the summary table on page 2.

Fishery Information

No fishery information is presented because there are no observed fishery-related mortalities or serious injury.

STATUS OF STOCK

The status of this stock relative to OSP in the US Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine population trends for blue whales. The total level of human-caused mortality and serious injury is unknown, but it is believed to be insignificant and approaching a zero mortality and serious injury rate. This is a strategic stock because the blue whale is listed as an endangered species under the ESA. A Recovery Plan has been published (Reeves *et al.* 1998) and is in effect.

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SPERM WHALE (*Physeter macrocephalus*): North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of the sperm whale in the U.S. Exclusive Economic Zone (EEZ) occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions (Figure 1). Waring *et al.* (1993, 2001) suggest that this offshore distribution is more commonly associated with the Gulf Stream edge and other features. However, the sperm whales that occur in the eastern U.S. Atlantic EEZ likely represent only a fraction of the total stock. The nature of linkages of the U.S. habitat with those to the south, north, and offshore is unknown. Historical whaling records compiled by Schmidly (1981) suggested an offshore distribution off the southeast U.S., over the Blake Plateau, and into deep ocean waters. In the southeast Caribbean, both large and small adults, as well as calves and juveniles of different sizes are reported (Watkins *et al.* 1985). Whether the northwestern Atlantic population is discrete from northeastern Atlantic is currently unresolved. The International Whaling Commission recognizes one stock for the North Atlantic. Based on reviews of many types of stock studies, (i.e., tagging, genetics, catch data, mark-recapture, biochemical markers, etc.) Reeves and Whitehead (1997) and Dufault *et al.* (1999) suggest that sperm whale populations have no clear geographic structure. Recent ocean wide genetic studies (Lyrholm and Gyllensten 1998; Lyrholm *et al.* 1999) indicate low genetic diversity, but strong differentiation between potential social (matrilineally related) groups. Further, the ocean-wide findings, combined with observations from other studies, indicate stable social groups, site fidelity, and latitudinal range limitations in groups of females and juveniles (Whitehead 2002). In contrast, males migrate to polar regions to feed and return to more tropical waters to breed. There exists one tag return of a male tagged off Browns Bank (Nova Scotia) in 1966 and returned from Spain in 1973 (Mitchell 1975). Another male taken off northern Denmark in August 1981 had been wounded the previous summer by whalers off the Azores (Reeves and Whitehead 1997). In the U.S. Atlantic EEZ waters, there appears to be a distinct seasonal cycle (CETAP 1982; Scott and Sadove 1997). In winter, sperm whales are concentrated east and northeast of Cape Hatteras. In spring, the center of distribution shifts northward to east of Delaware and Virginia, and is widespread throughout the central portion of the mid-Atlantic bight and the southern portion of Georges Bank. In summer, the distribution is similar but now also includes the area east and north of Georges Bank and into the Northeast Channel region, as well as the continental shelf (inshore of the 100 m isobath) south of New England. In the fall, sperm whale occurrence south of New England on the continental shelf is at its highest level, and there remains a continental shelf edge occurrence in the mid-Atlantic bight. Similar inshore (<200 m) observations have been made on the southwestern (Kenney, pers. comm) and eastern Scotian Shelf, particularly in the region of “the Gully” (Whitehead *et al.* 1991).

Geographic distribution of sperm whales may be linked to their social structure and their low reproductive rate and both of these factors have management implications. Several basic groupings or social units are generally recognized — nursery schools, harem or mixed schools, juvenile or immature schools, bachelor schools, bull schools or pairs, and solitary bulls (Best 1979; Whitehead *et al.* 1991; Christal *et al.* 1998). These groupings have a distinct geographical distribution, with females and juveniles generally based in tropical and subtropical waters, and males more wide-ranging and occurring in higher latitudes. Male sperm whales are present off and sometimes on the continental shelf along the entire east coast of Canada south of Hudson Strait, whereas, females rarely migrate north of the southern limit of the Canadian EEZ (Reeves and Whitehead 1997; Whitehead 2002). Off the northeast U.S., CETAP and NMFS/NEFSC sightings in shelf-edge and off-shelf waters included

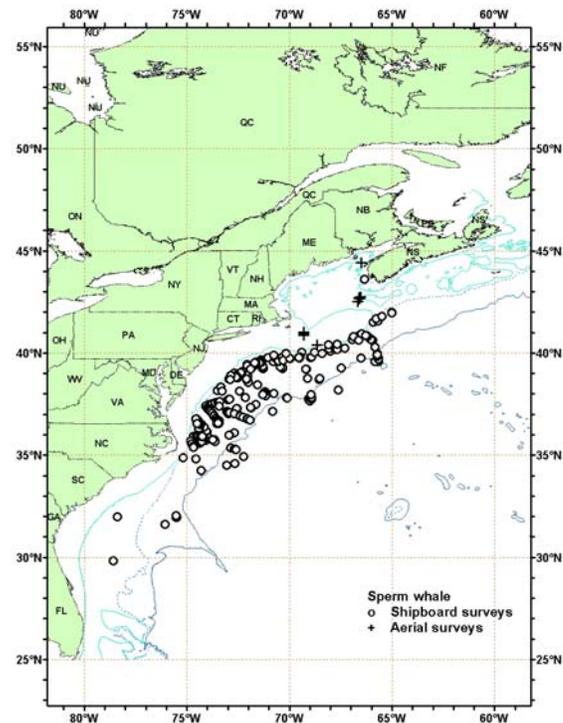


Figure 1. Distribution of sperm whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, 1999, 2002, 2004 and 2006. Isobaths are the 100m, 1,000m, and 4,000m depth contours.

many social groups with calves/juveniles (CETAP 1982; Waring *et al.* 1992, 1993). The basic social unit of the sperm whale appears to be the mixed school of adult females plus their calves and some juveniles of both sexes, normally numbering 20-40 animals in all. There is evidence that some social bonds persist for many years (Christal *et al.* 1998).

POPULATION SIZE

Total numbers of sperm whales off the U.S. or Canadian Atlantic coast are unknown, although several estimates from selected regions of the habitat do exist for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best recent abundance estimate for sperm whales is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 4,804 (CV=0.38), where the estimate from the northern U.S. Atlantic is 2,607 (CV=0.57), and from the southern U.S. Atlantic is 2,197 (CV=0.47). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat. Because all the sperm whale estimates presented here were not corrected for dive-time, they are likely downwardly biased and an underestimate of actual abundance. The average dive-time of sperm whales is approximately 30 - 60 min (Whitehead *et al.* 1991; Watkins *et al.* 1993; Amano and Yoshioka 2003; Watwood *et al.* 2006), therefore, the proportion of time that they are at the surface and available to visual observers is assumed to be low.

Although the stratification schemes used in the 1990-2004 surveys did not always sample the same areas or encompass the entire sperm whale habitat, they did focus on segments of known or suspected high-use habitats off the northeastern U.S. coast. The collective 1990- 2004 data suggest that, seasonally, at least several thousand sperm whales are occupying these waters. Sperm whale abundance may increase offshore, particularly in association with Gulf Stream and warm-core ring features; however, at present there is no reliable estimate of total sperm whale abundance in the western North Atlantic.

Earlier abundance estimates

An abundance of 219 (CV=0.36) sperm whales 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). An abundance of 338 (CV=0.31) sperm whales 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 (NMFS 1990; Waring *et al.* 1992). An abundance of 736 (CV=0.33) sperm whales was estimated from a June and July 1991 shipboard line- transect sighting survey conducted primarily between the 200 and 2,000-m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998). An abundance of 705 (CV=0.66) and 337 (CV=0.50) sperm whales was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (NMFS 1991). An abundance of 116 (CV=0.40) sperm whales 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 623 (CV=0.52) sperm whales was estimated from an August 1994 shipboard line transect survey conducted within a Gulf Stream warm-core ring located in continental slope waters southeast of Georges Bank (NMFS 1994). An abundance of 2,698 (CV=0.67) sperm whales 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 1996). An abundance of 2,848 (CV=0.49) sperm whales was estimated from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38°N). An abundance of 1,181 (CV=0.51) sperm whales was estimated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, 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.

Recent surveys and abundance estimates

An abundance of 2,607 (CV=0.57) for sperm whales was estimated from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (about 38°N) to the Bay of Fundy (about 45°N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and $g(0)$, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for $g(0)$ and biases due to school size and other potential covariates (Palka 2005).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and

Maryland (27.5 and 38°N) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and there were a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were analyzed to correct for visibility bias ($g(0)$) and group-size bias employing line transect distance analysis and the direct duplicate estimator (Palka 1995; Buckland *et al.*, 2001). The resulting abundance estimate for sperm whales between Florida and Maryland was 2,197 (CV=0.47)(Table 1).

Table 1. Summary of abundance estimates for the western North Atlantic sperm whale. 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
Jun-Aug 2004	Maryland to the Bay of Fundy	2,607	0.57
Jun-Aug 2004	Florida to Maryland	2,197	0.47
Jun-Aug 2004	Bay of Fundy to Florida (COMBINED)	4,804	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 sperm whales is 4,804 (CV=0.38). The minimum population estimate for the western North Atlantic sperm whale is 3,539.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. While more is probably known about sperm whale life history in other areas, some life history and vital rates information is available for the northwest Atlantic. These include: calving interval is 4-6 years; lactation period is 24 months; gestation period is 14.5-16.5 months; births occur mainly in July to November; length at birth is 4.0 m; length at sexual maturity 11.0-12.5 m for males and 8.3-9.2 m for females; mean age at sexual maturity is 19 years for males and 9 years for females; and mean age at physical maturity is 45 years for males and 30 years for females (Best 1974; Best *et al.* 1984; Lockyer 1981; Rice 1989).

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 3,539. 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 0.10 because the sperm whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic sperm whale is 7.1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During 2001-2005, human caused mortality was 0.2 sperm whales per year (CV=unknown). This is derived from two components: 0 sperm whales per year (CV=unknown) from U.S. fisheries using observer data and 0.2 sperm whales per year from ship strikes.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

Several sperm whale entanglements have been documented. In July 1990, a sperm whale was entangled and subsequently released (injured) from the now prohibited pelagic drift gillnet near the continental shelf edge on southern Georges Bank. This resulted in an estimated annual fishery-related mortality and serious injury of 4.4 (CV=1.77) for 1990. In August 1993, a dead sperm whale, with longline gear wound tightly around the jaw, was found floating about 20 miles off Mt Desert Rock. In October 1994, a sperm whale was successfully disentangled from a fine- mesh gillnet in Birch Harbor, Maine. During June 1995, one sperm whale was entangled with “gear in/around several body parts” then released injured from a pelagic drift gillnet haul located on the shelf edge between Oceanographer and Hydrographer Canyons on Georges Bank. In May 1997, a sperm whale entangled in net with three buoys trailing was sighted 130 nm northwest of Bermuda. No information on the status of the animal was provided.

Other Mortality

Four hundred twenty-four sperm whales were harvested in the Newfoundland-Labrador area between 1904 and 1972 and 109 male and no female sperm whales were taken near Nova Scotia in 1964-1972 (Mitchell and Kozicki 1984) in a Canadian whaling fishery. There was also a well-documented sperm whale fishery based on the west coast of Iceland. Other sperm whale catches occurred near West Greenland, the Azores, Madeira, Spain, Spanish Morocco, Norway (coastal and pelagic), the Faroes, and Britain. At present, because of their general offshore distribution, sperm whales are less likely to be impacted by humans and those impacts that do occur are less likely to be recorded. There has been no complete analysis and reporting of existing data on this topic for the western North Atlantic.

During 1994-2000, eighteen sperm whale strandings have been documented along the U.S. Atlantic coast between Maine and Miami, Florida (NMFS unpublished data). One 1998 and one 2000 stranding off Florida showed signs of human interactions. The 1998 animal’s head was severed, but it is unknown if it occurred pre- or post-mortem. The 2000 animal had fishing gear in the blowhole. In October 1999, a live sperm whale calf stranded on eastern Long Island, and was subsequently euthanized. Also, a dead calf was found in the surf off Florida in 2000.

During 2001 to 2005, fifteen sperm whale strandings were documented along the U.S. Atlantic coast and in Puerto Rico and the EEZ according the NER and SER strandings databases (Table 2). Except for the sperm whale struck by a naval vessel in the EEZ in 2001, there were no confirmed documented signs of human interactions on the other animals.

STATE	2001	2002	2003	2004	2005	TOTAL
Massachusetts	1	1				2
North Carolina			2	1		3
South Carolina		1				1
Florida		2	2	1	1	6
EEZ	1 ¹					1
Puerto Rico				1	1	2
TOTAL	2	4	4	3	2	15

¹ U.S. Navy reported ship strike

In eastern Canada, 6 dead strandings were reported in Newfoundland/Labrador in 1987-2005; 20 dead strandings along Nova Scotia in 1988-2005; 9 dead strandings on Prince Edward Island in 1988-2005; 2 dead strandings in Quebec in 1992; 5 dead strandings in New Brunswick in 2005; and 13 animals in 8 stranding events on Sable Island, Nova Scotia in 1970-1998 (Reeves and Whitehead 1997; Hooker *et al.* 1997; Lucas and Hooker 2000). Sex was recorded for 11 of the 13 Sable island animals, and all were male, which is consistent with sperm whale distribution patterns (Lucas and Hooker 2000).

Recent mass strandings have been reported in the North Sea, including; winter 1994/1995 (21); winter 1995/1996 (16); and winter 1997/1998 (20). Reasons for the strandings are unknown, although multiple causes (e.g., unfavorable North Sea topography, ship strikes, global changes in water temperature and prey distribution, and pollution) have been suggested (Holsbeek *et al.* 1999).

Ship strikes are another source of human- induced mortality. In May 1994 a ship-struck sperm whale was observed

south of Nova Scotia (Reeves and Whitehead 1997) and in May 2000 a merchant ship reported a strike in Block Canyon (NMFS, unpublished data). In spring, Block Canyon is a major pathway for sperm whales entering southern New England continental shelf waters in pursuit of migrating squid (CETAP 1982; Scott and Sadove 1997).

A potential human-caused source of mortality is from accumulation of stable pollutants (e.g., polychlorobiphenyls (PCBs), chlorinated pesticides (DDT, DDE, dieldrin, etc.), polycyclic aromatic hydrocarbons (PAHs), and heavy metals) in long lived, high-trophic level animals. Analysis of tissue samples obtained from 21 sperm whales that mass-stranded in the North Sea in 1994/1995 indicated that mercury, PCB, DDE, and PAH levels were low and similar to levels reported for other marine mammals (Holsbeek *et al.* 1999). Cadmium levels were high and double reported levels in North Pacific sperm whales. Although the 1994/1995 strandings were not attributable to contaminant burdens, Holsbeek *et al.* (1999) suggest that the stable pollutants might affect the health or behavior of North Atlantic sperm whales.

Using stranding and entanglement data, during 2001-2005, one sperm whale was confirmed struck by a ship, thus, there is an annual average of 0.2 sperm whales per year struck by ships. No sperm whale stranding mortalities during this period were confirmed fishery interactions.

STATUS OF STOCK

The status of this stock relative to OSP in U.S. Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine population trends. The current stock abundance estimate was based upon a small portion of the known stock range. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR, and therefore can be considered to be insignificant and approaching a zero mortality and serious injury rate. This is a strategic stock because the species is listed as endangered under the ESA. A Draft Recovery Plan for sperm whales has been prepared and is available for review (NMFS 2006).

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DWARF SPERM WHALE (*Kogia sima*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The dwarf sperm whale (*Kogia sima*) appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989; McAlpine 2002). Sightings of these animals in the western North Atlantic occur in oceanic waters (Mullin and Fulling 2003; NMFS unpublished data), although there are no stranding records for the east Canadian coast (Willis and Baird 1998). Dwarf sperm whales and pygmy sperm whales (*K. breviceps*) are difficult to differentiate at sea (Caldwell and Caldwell 1989, Wursig *et al.* 2000), and sightings of either species are often categorized as *Kogia* sp. Diagnostic morphological characters have been useful in distinguishing the two *Kogia* species (Barros and Duffield 2003), thus enabling researchers to use stranding data in distributional and ecological studies. Specifically, the distance from the snout to the center of the blowhole in proportion to the animal's total length, as well as the height of the dorsal fin in proportion to the animal's total length, can be used to differentiate between the two *Kogia* species when such measurements are obtainable (Barros and Duffield 2003; Handley 1966). Duffield *et al.* (2003) propose using the molecular weights of myoglobin and hemoglobin, as determined by blood or muscle tissues of stranded animals, as a quick and robust way to provide species confirmation.

Using hematological as well as stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. This may result in differential exposure to marine debris, collision with vessels and other anthropogenic activities between the two *Kogia* species.

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

POPULATION SIZE

Total numbers of dwarf sperm whales off the U.S. or Canadian Atlantic coast are unknown, although estimates from selected regions of the habitat do exist for select time periods. Because *Kogia sima* and *Kogia breviceps* are difficult to differentiate at sea, the reported abundance estimates are for both species of *Kogia*. The best abundance estimate for *Kogia* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 395 animals (CV=0.40), where the estimate from the northern U.S. Atlantic is 358 (CV=0.44), and from the southern U.S. Atlantic is 37 (CV=0.75). This joint estimate is considered the best because these two surveys together have the most complete coverage of the species' habitat.

Earlier abundance estimates

An abundance estimate of 695 (CV=0.49) *Kogia* sp. was obtained from the sum of the estimate of 115 (CV=0.61) *Kogia* sp. from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of trackline in waters north of Maryland (38°N) (Palka 2006), and the estimate of 580 (CV=0.57) *Kogia* sp., obtained from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003).

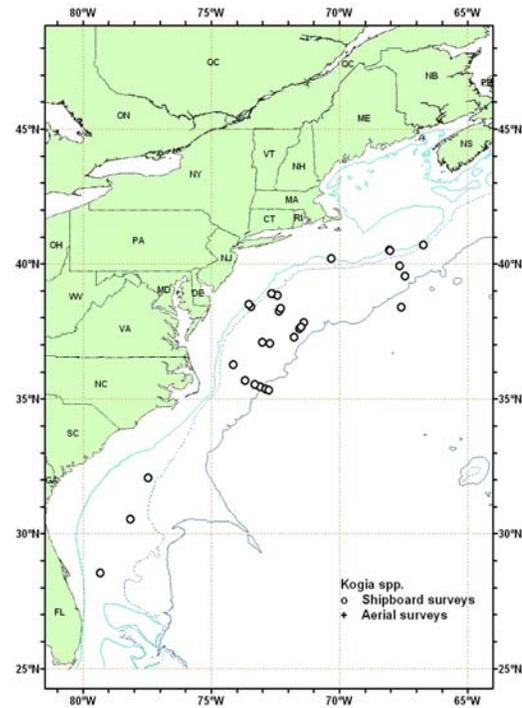


Figure 1. Distribution of *Kogia* sp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 2004. Isobaths are at 100 m, 1,000 m and 4,000 m.

Recent surveys and abundance estimates

An abundance estimate of 358 (CV= 0.44) for *Kogia* sp. was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (about 38° N) to the Bay of Fundy (about 45° N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and $g(0)$, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for $g(0)$ and biases due to school size and other potential covariates (Palka 2005).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥ 50 m) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the Mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias $g(0)$ and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for *Kogia* sp. between Florida and Maryland was 37 animals (CV=0.75).

1. Summary of abundance estimates for the western North Atlantic <i>Kogia</i> sp. Month, year, and covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation			
Month/Year		N_{best}	CV
Jun-Aug 2004	Maryland to Bay of Fundy	358	0.44
Jun-Aug 2004	Florida to Maryland	37	0.75
Jun-Aug 2004	Bay of Fundy to Florida (COMBINED)	395	0.40

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 *Kogia* sp. is 395 (CV=0.40). The minimum population estimate for *Kogia* sp. is 285 animals.

Current Population Trend

The available information is insufficient to evaluate population trends for this species in the western North Atlantic.

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 *Kogia* sp. is 285. 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 *Kogia* sp. is 2.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to these stocks during 2001-2005 was zero for *Kogia* sp., as there were no reports of mortality or serious injury to these species.

Earlier Interactions

No *Kogia* sp. mortalities were observed in 1977-1991 foreign fishing activities.

Pelagic Longline

Between 1992 and 2005, 1 *Kogia* sp. was hooked, released alive and considered seriously injured in 2000 (in the Florida East coast fishing area) (Yeung 2001).

Other Mortality

No dwarf sperm whales were reported to strand in Nova Scotia from 1990-2005 (T. Wimmer, Nova Scotia Marine Animal Response Society, pers. comm.). From 2001-2005, 30 dwarf sperm whales were reported stranded along the U.S. Atlantic coast and 2 were reported stranded in Puerto Rico (Table 2). In addition to the above strandings of *Kogia sima*, there were 11 strandings reported as *Kogia* sp. There were no documented strandings of dwarf sperm whales along the U.S. Atlantic coast during 2001-2005 which were classified as likely caused by fishery or human interactions.

Table 2. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2001-2005. Strandings which were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.

STATE	2001			2002			2003			2004			2005			TOTALS			
	Ks	Kb	Sp	Ks	Kb	Sp													
Massachusetts	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
New York	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Delaware	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Carolina	1	0	1	0	0	1	4	0	0	2	5	0	4	5	0	11	10	2	0
South Carolina	1	0	0	0	0	0	2	0	0	0	8	0	0	8	0	3	16	0	0
Georgia	0	0	0	0	0	1	2	0	1	1	10	0	2	3	0	5	13	2	0
Florida	2	0	0	3	0	2	2	0	3	3	8	1	0	3	1	10	11	7	0
Puerto Rico	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
TOTALS	4	0	1	5	0	4	10	0	4	6	31	1	7	20	1	32	51	11	0

Historical stranding records (1883-1988) of dwarf sperm whales in the southeastern U.S. (Credle 1988), and strandings recorded during 1988-1997 (Barros *et al.* 1998) indicate that this species accounts for about 17% of all *Kogia* strandings in the entire southeastern U.S. waters. During the period 1990-October 1998, 3 dwarf sperm whale strandings occurred in the northeastern U.S. (Maryland, Massachusetts, and Rhode Island), whereas 43 strandings were documented along the U.S. Atlantic coast between North Carolina and the Florida Keys in the same period. A pair of latex examination gloves was retrieved from the stomach of a dwarf sperm whale stranded in Miami in 1987 (Barros *et al.* 1990). In the period 1987-1994, 1 animal had possible propeller cuts on or near the flukes.

A Mid-Atlantic Offshore Small Cetacean Unusual Mortality Event (UME), was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Fifteen pygmy sperm whales (*Kogia breviceps*) and one dwarf sperm whale (*Kogia sima*) were involved in this UME. Two pygmy sperm whales were involved in a multispecies UME in North Carolina in January of 2005 (Hohn *et al.* 2006). Although anthropogenic

noise was not definitively implicated, the January 2005 event was associated in time and space with naval sonar activity. Potential risk to this species and others from anthropogenic noise is of concern.

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.

Rehabilitation challenges for *Kogia* sp. are numerous due to limited knowledge regarding even the basic biology of these species. Advances in recent rehabilitation success has potential implications for future release and tracking of animals at sea to potentially provide information on distribution, movements and habitat use of these species (Manire *et al.* 2004).

STATUS OF STOCK

The status of *Kogia* sp. relative to OSP in the western U.S. Atlantic EEZ is unknown. These species are not listed as endangered or threatened under the Endangered Species Act. There is insufficient information with which to assess population trends. Total U.S. fishery-related mortality and serious injury for these stocks is less than 10% of the calculated PBR and therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual human-related mortality and serious injury rate does not exceed the PBR, therefore *Kogia* sp. are not strategic stocks.

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PYGMY SPERM WHALE (*Kogia breviceps*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy sperm whale (*Kogia breviceps*) appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989; McAlpine 2002). Sightings of these animals in the western North Atlantic occur in oceanic waters (Mullin and Fulling 2003; SEFSC unpublished data), although there are no stranding records for the east Canadian coast (Willis and Baird 1998). Pygmy sperm whales and dwarf sperm whales (*K. sima*) are difficult to differentiate at sea (Caldwell and Caldwell 1989, Wursig *et al.* 2000), and sightings of either species are often categorized as *Kogia* sp. Diagnostic morphological characters have been useful in distinguishing the two *Kogia* species (Barros and Duffield 2003; Handley 1966), thus enabling researchers to use stranding data in distributional and ecological studies. Specifically, the distance from the snout to the center of the blowhole in proportion to the animal's total length, as well as the height of the dorsal fin in proportion to the animal's total length, can be used to differentiate between the two *Kogia* species when such measurements are obtainable (Barros and Duffield 2003). Duffield *et al.* (2003) propose using the molecular weights of myoglobin and hemoglobin, as determined by blood or muscle tissues of stranded animals, as a quick and robust way to provide species confirmation.

Using hematological as well as stable-isotope data, Barros *et al.* (1998) speculated that dwarf sperm whales may have a more pelagic distribution than pygmy sperm whales, and/or dive deeper during feeding bouts. This may result in differential exposure to marine debris, collision with vessels and other anthropogenic activities between the two *Kogia* species.

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

POPULATION SIZE

Total numbers of pygmy sperm whales off the U.S. or Canadian Atlantic coast are unknown, although estimates from selected regions of the habitat do exist for select time periods. Because *Kogia breviceps* and *Kogia sima* are difficult to differentiate at sea, the reported abundance estimates are for both species of *Kogia*. The best abundance estimate for *Kogia* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 395 animals (CV=0.40), where the estimate from the northern U.S. Atlantic is 358 (CV=0.44), and from the southern U.S. Atlantic is 37 (CV=0.75). This joint estimate is considered the best because these two surveys together have the most complete coverage of the species' habitat.

Earlier abundance estimates

An abundance estimate of 695 (CV=0.49) *Kogia* sp. was obtained from the sum of the estimate of 115 (CV=0.61) *Kogia* sp. from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38°N) (Palka 2006), and the estimate of 580 (CV=0.57) *Kogia* sp., obtained from a shipboard line-transect sighting survey conducted between 8 July and

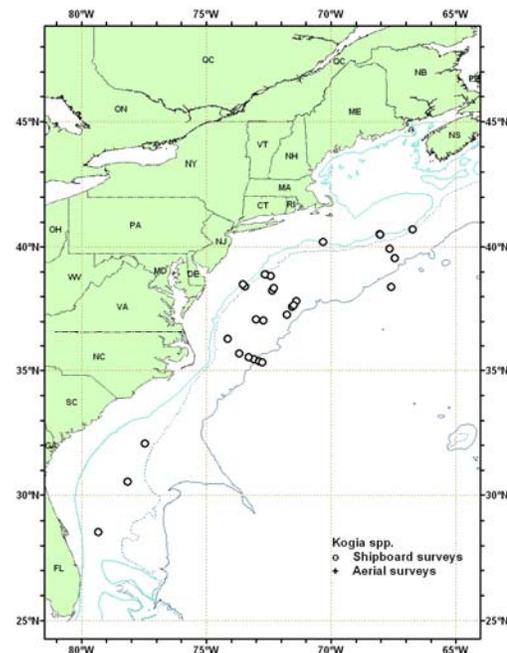


Figure 1. Distribution of *Kogia* sp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 2004. Isobaths are at 100 m, 1,000 m and 4,000 m.

17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003).

Recent surveys and abundance estimates

An abundance estimate of 358 (CV= 0.44) *Kogia* sp. was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38° N) to the Bay of Fundy (45° N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and $g(0)$, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for $g(0)$ and biases due to school size and other potential covariates (Palka 2005).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥ 50 m) between 27.5 and 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the Mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias $g(0)$ and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for *Kogia* sp. between Florida and Maryland was 37 animals (CV=0.75).

Table 1. Summary of abundance estimates for the western North Atlantic <i>Kogia</i> sp. 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
Jun-Aug 2004	Maryland to Bay of Fundy	358	0.44
Jun-Aug 2004	Florida to Maryland	37	0.75
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	395	0.40

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 *Kogia* sp. is 395 animals (CV=0.40). The minimum population estimate for *Kogia* sp. is 285 animals.

Current Population Trend

The available information is insufficient to evaluate population trends for this species in the western North Atlantic.

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 *Kogia* sp. is 285. 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 *Kogia* sp. is 2.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to these stocks during 2001-2005 was zero for *Kogia* sp., as there were no reports of mortality or serious injury to these species.

Earlier Interactions

No *Kogia* sp. mortalities were observed in 1977-1991 foreign fishing activities.

Pelagic Longline

Between 1992 and 2005, 1 *Kogia* sp. was hooked, released alive and considered seriously injured in 2000 (Yeung 2001).

Other Mortality

No pygmy sperm whales were reported to strand in Nova Scotia from 1990-2005 (T. Wimmer, Nova Scotia Marine Animal Response Society, pers. comm.). From 2001-2005, 51 pygmy sperm whales were reported stranded along the U.S. Atlantic coast (Table 2).

Table 2. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2001-2005. Strandings which were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.

STATE	2001			2002			2003			2004			2005			TOTALS			
	K s	K b	S p																
Massachusetts	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0
New York	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0
Delaware	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
North Carolina	1	0	1	0	0	1	4	0	0	2	5	0	4	5	0	11	10	2	0
South Carolina	1	0	0	0	0	0	2	0	0	0	8	0	0	8	0	3	16	0	0
Georgia	0	0	0	0	0	1	2	0	1	1	10	0	2	3	0	5	13	2	0
Florida	2	0	0	3	0	2	2	0	3	3	8	1	0	3	1	10	11	7	0
Puerto Rico	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
TOTALS	4	0	1	5	0	4	10	0	4	6	31	1	7	20	1	32	51	11	0

A Mid-Atlantic Offshore Small Cetacean UME, was declared when 33 small cetaceans stranded from Maryland to Georgia between July 2004 and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Fifteen pygmy sperm whales (*Kogia breviceps*) and one dwarf sperm whale (*Kogia sima*) were involved in this UME. Two pygmy sperm whales were involved in a multispecies UME in North Carolina in January of 2005 (Hohn *et al.* 2006). Although anthropogenic noise was not definitively implicated, the January 2005 event was associated in time and space with naval sonar activity. Potential risk to this species and others from anthropogenic noise is of concern.

There were 4 documented strandings of pygmy sperm whales along the U.S. Atlantic coast during 1999- 2005 which were classified as involving fishery or human interactions - 1 in Florida in 1999, 1 in Puerto Rico in 2000, 1 in North Carolina in 2001, and 1 in Massachusetts in 2005. In one of the strandings in 2002 of a pygmy sperm whale, red plastic debris was found in the stomach along with squid beaks.

Historical stranding records (1883-1988) of pygmy sperm whales in the southeastern U.S. (Credle 1988) and strandings recorded during 1988-1997 (Barros *et al.* 1998) indicate that this species accounts for about 83% of all *Kogia* sp. strandings in this area. During the period 1990-October 1998, 21 pygmy sperm whale strandings occurred in the northeastern U.S. (Delaware, New Jersey, New York and Virginia), whereas 194 strandings were documented along the U.S. Atlantic coast between North Carolina and the Florida Keys in the same period. Remains of plastic bags and other marine debris have been retrieved from the stomachs of 13 stranded pygmy sperm whales in the southeastern U.S. (Barros *et al.* 1990, 1998), and at least on one occasion the ingestion of plastic debris is believed to have been the cause of death. During the period 1987-1994, 1 animal had possible propeller cuts on its flukes.

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.

Rehabilitation challenges for *Kogia* sp. are numerous due to limited knowledge regarding even the basic biology of these species. Advances in recent rehabilitation success has potential implications for future release and tracking of animals at sea to potentially provide information on distribution, movements and habitat use of these species (Manire *et al.* 2004).

STATUS OF STOCK

The status of *Kogia* sp. relative to OSP in the western U.S. Atlantic EEZ is unknown. These species are not listed as endangered or threatened under the Endangered Species Act. There is insufficient information with which to assess population trends. Total U.S. fishery-related mortality and serious injury for these stocks is less than 10% of the calculated PBR and therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual human-related mortality and serious injury rate does not exceed the PBR, therefore *Kogia* sp. are not strategic stocks.

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KILLER WHALE (*Orcinus orca*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Killer whales are characterized as uncommon or rare in waters of the U.S. Atlantic Exclusive Economic Zone (EEZ) (Katona *et al.* 1988). The 12 killer whale sightings constituted 0.1% of the 11,156 cetacean sightings in the 1978-81 CETAP surveys (CETAP 1982). The same is true for eastern Canadian waters, where the species has been described as relatively uncommon and numerically few (Mitchell and Reeves 1988). Their distribution, however, extends from the Arctic ice-edge to the West Indies. They are normally found in small groups, although 40 animals were reported from the southern Gulf of Maine in September 1979, and 29 animals in Massachusetts Bay in August 1986 (Katona *et al.* 1988). In the U.S. Atlantic EEZ, while their occurrence is unpredictable, they do occur in fishing areas, perhaps coincident with tuna, in warm seasons (Katona *et al.* 1988; NMFS unpublished data). In an extensive analysis of historical whaling records, Reeves and Mitchell (1988) plotted the distribution of killer whales in offshore and mid-ocean areas. Their results suggest that the offshore areas need to be considered in present-day distribution, movements, and stock relationships.

Stock definition is unknown. Results from other areas (e.g., the Pacific Northwest and Norway) suggest that social structure and territoriality may be important.

POPULATION SIZE

The total number of killer whales off the eastern U.S. coast is unknown.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. The maximum net productivity rate was assumed to be 0.04 for purposes of this assessment. This value is based on theoretical calculations showing that cetacean populations may not generally 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 unknown. 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 killer whale is unknown because the minimum population size cannot be determined.

ANNUAL HUMAN-CAUSED MORTALITY

In 1994, one killer whale was caught in the New England multispecies sink gillnet fishery but released alive. No takes were documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Fishery Information

Data on current incidental takes in U.S. fisheries are available from several sources. In 1986, NMFS established a mandatory self-reported fishery information system for large pelagic fisheries. Data files are maintained at the Southeast Fisheries Science Center (SEFSC). The Northeast Fisheries Science Center (NEFSC) Fisheries 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.

There have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, New England multispecies sink gillnet, Mid-Atlantic coastal sink gillnet, and North Atlantic bottom trawl fisheries.

STATUS OF STOCK

The status of killer whales relative to OSP in U.S. Atlantic EEZ is unknown. Because there are no observed mortalities or serious injury between 1990 and 1995, the total fishery-related mortality and serious injury for this stock is considered insignificant and approaching zero mortality and serious injury rate. 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 the population trends for this species. This is not a strategic stock because, although PBR could not be calculated, there is no evidence of human-induced mortality.

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PYGMY KILLER WHALE (*Feresa attenuata*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy killer whale is distributed worldwide in tropical to sub-tropical waters (Jefferson *et al.* 1994). Pygmy killer whales are assumed to be part of the cetacean fauna of the tropical western North Atlantic. The paucity of sightings is probably due to a naturally low number of groups compared to other cetacean species. Sightings in the more extensively surveyed northern Gulf of Mexico occur in oceanic waters (Mullin *et al.* 1994; Mullin and Fulling 2004). Sightings of pygmy killer whales were documented in all seasons during aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). The western North Atlantic population is provisionally being considered one stock for management purposes. Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The numbers of pygmy killer whales off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. A group of 6 pygmy killer whales was sighted during a 1992 vessel survey of the western North Atlantic off of Cape Hatteras, North Carolina, in waters >1500 m deep (Hansen *et al.* 1994), but this species was not sighted during subsequent surveys (NMFS 1999; NMFS 2002; Mullin and Fulling 2003). Abundance was not estimated for pygmy killer whales from the 1992 vessel survey because the sighting was not made during line-transect sampling effort; therefore, the population size of pygmy killer whales is unknown.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for this stock.

Current Population Trend

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

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 history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal level (PBR) is the product of the 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 unknown. 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 stock of pygmy killer whales is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to this stock during 2001-2005 was zero pygmy killer whales, as there were no reports of mortality or serious injury to pygmy killer whales (Yeung 2001; Garrison 2003; Garrison and Richards 2004; Fairfield-Walsh and Garrison 2006).

There has historically been some take of this species in small cetacean fisheries in the Caribbean (Caldwell and Caldwell 1971).

Other Mortality

From 2001-2005, 3 pygmy killer whales were reported stranded between Maine and Puerto Rico (Table 1). The total includes 1 animal stranded in South Carolina, 1 in Georgia in 2003, and 1 animal stranded in Georgia in 2004,

though there were no indications of human interactions for these stranded animals.

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.

Table 1. Pygmy killer whale (*Feresa attenuata*) reported strandings along the U.S. Atlantic coast, 2001-2005.

STATE	2001	2002	2003	2004	2005	TOTALS
South Carolina	0	0	1	0	0	1
Georgia	0	0	1	1	0	2
TOTALS	0	0	2	1	0	3

STATUS OF STOCK

The status of pygmy killer whales, relative to OSP, in the U.S. western North 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 size or trends and PBR cannot be calculated for this stock. No fishery-related mortality and serious injury has been observed since 1999; therefore, total U.S. fishery-related mortality and serious injury rate can be considered insignificant and approaching zero mortality and serious injury. This is not a strategic stock.

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MELON-HEADED WHALE (*Peponocephala electra*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The melon-headed whale is distributed worldwide in tropical to sub-tropical waters (Jefferson *et al.* 1994) and is assumed to be part of the cetacean fauna of the tropical western North Atlantic. The paucity of sightings is probably due to a naturally low number of groups compared to other cetacean species. Sightings in the more extensively surveyed northern Gulf of Mexico occur in oceanic waters (Mullin *et al.* 1994; Mullin and Fulling 2004). Sightings of melon-headed whales in the northern Gulf of Mexico were documented in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). The western North Atlantic population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The numbers of melon-headed whales off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. A group of melon-headed whales was sighted during both a 1999 (20 whales) and 2002 (80 whales) vessel survey of the western North Atlantic off of Cape Hatteras, North Carolina in waters >2500 m deep (Figure 1; NMFS 1999, 2002). Abundances have not been estimated from the 1999 and 2002 vessel surveys in western North Atlantic because the sighting was not made during line-transect sampling effort; therefore the population size of melon-headed whales is unknown. No melon-headed whales have been observed in any other surveys.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for this stock.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

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 history (Barlow *et al.* 1995).

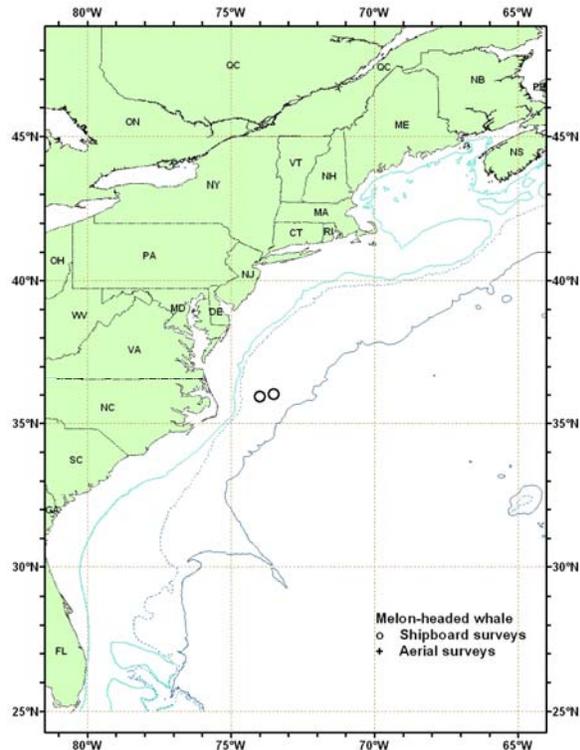


Figure 1. Distribution of melon-headed whales from SEFSC vessel surveys during 1998-2002. All sightings are shown. Solid lines indicate the 100 m, 1,000 m, and 4,000 m isobaths.

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal level (PBR) is the product of the 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 unknown. 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 stock of melon-headed whales is unknown because the minimum population size is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to this stock during 2001-2005 was zero, as there were no reports of mortality or serious injury to melon-headed whales.

Other Mortality

From 2001-2005, 1 melon-headed whale stranded in New Jersey and one in Georgia in 2004. Prior to this time, 1 melon-headed whale was reported stranded in Puerto Rico in 1999. No evidence of human interaction was apparent for any of the stranded animals.

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 or human interaction.

STATUS OF STOCK

The status of melon-headed whales, relative to OSP, in the western North 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 size or trends and PBR cannot be calculated for this stock. No fishery-related mortality and serious injury has been observed since 1999; therefore, total U.S. fishery-related mortality and serious injury rate can be considered insignificant and approaching zero mortality and serious injury. This is not a strategic stock.

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WHITE-BEAKED DOLPHIN (*Lagenorhynchus albirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

White-beaked dolphins are the more northerly of the two species of *Lagenorhynchus* in the northwest Atlantic (Leatherwood *et al.* 1976). The species is found in waters from southern New England to southern Greenland and Davis Straits (Leatherwood *et al.* 1976; CETAP 1982), across the Atlantic to the Barents Sea and south to at least Portugal (Reeves *et al.* 1999). Differences in skull features indicate that there are at least two separate stocks, one in the eastern and one in the western North Atlantic (Mikkelsen and Lund 1994). No genetic analyses have been conducted to corroborate this stock structure.

In waters off the northeastern U.S. coast, white-beaked dolphin sightings are concentrated in the western Gulf of Maine and around Cape Cod (CETAP 1982). The limited distribution of this species in U.S. waters has been attributed to opportunistic feeding (CETAP 1982). Prior to the 1970's, white-sided dolphins (*L. acutus*) in U.S. waters were found primarily offshore on the continental slope, while white-beaked dolphins 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 increase in sand lance in the continental shelf waters (Katona *et al.* 1993; Kenney *et al.* 1996).

In late March 2001, one group of 18 animals was seen about 60 nautical miles east of Provincetown, Massachusetts during a NMFS aerial marine mammal survey (NMFS unpublished data). In addition, during spring 2001 and 2002, white-beaked dolphins stranded on beaches in New York and Massachusetts (see Other Mortality section below).

POPULATION SIZE

The total number of white-beaked dolphins in U.S. and Canadian waters is unknown, although one old abundance estimate is available for part of the known habitat in U.S. waters, two other estimates are available from Canadian waters, and one estimate is available from August 2006 from waters in the Gulf of Maine and Scotian shelf (Table 1). The best and only recent abundance estimate for the western North Atlantic white-beaked dolphin is 2,003 (CV=0.94), an estimate derived aerial survey data collected in August 2006. It is assumed this estimate is negatively biased because the survey only covered part of the species' habitat.

Earlier abundance estimates

A population size of 573 white-beaked dolphins (CV=0.69) 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). The estimate is based on spring data because the greatest proportion of the

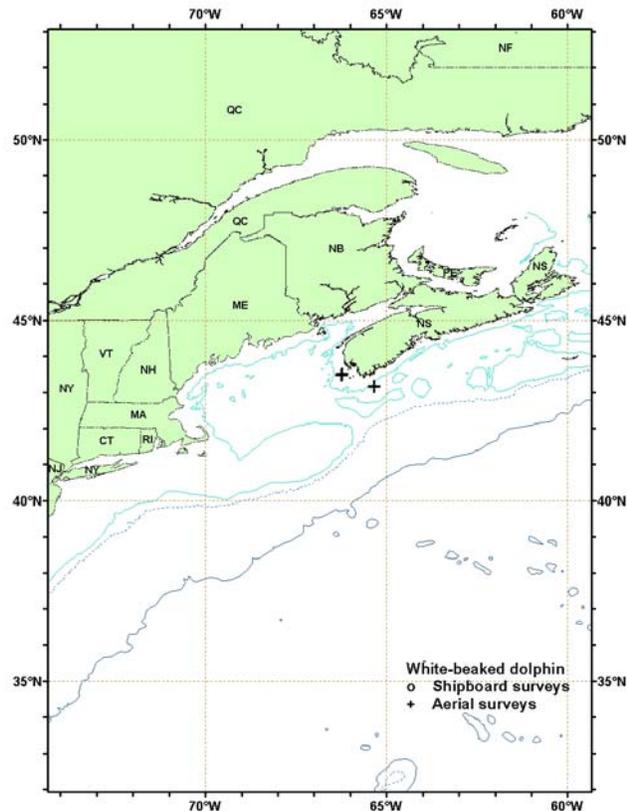


Figure 1. Distribution of white-beaked dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004 and 2006. Isobaths are the 100m, 1000m and 4000m depth contours.

population off the northeast U.S. coast appeared in the study area during this season, according to the CETAP data. This estimate does not include a correction for dive-time, or to $g(0)$, 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), and its dated nature. A population size of 5,500 white-beaked dolphins was estimated based on an aerial survey off eastern Newfoundland and southeastern Labrador (Alling and Whitehead 1987). A population size of 3,486 white-beaked dolphins (95% confidence interval (CI)=2,001-4,971) was estimated from a ship-based survey of a small segment of the Labrador Shelf in August 1982 (Alling and Whitehead 1987). A CV was not given, but assuming a symmetric CI, it would be 0.22. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An estimate of abundance from an August 2006 survey was 2,003 white-beaked dolphins (CV=0.94). Three aerial line transect abundance surveys were conducted in the summers of 2002, 2004 and 2006 on the NOAA Twin Otter using the circle-back data collection methods, which allow the estimation of $g(0)$ (Palka 2005). The estimate of $g(0)$ was derived from the pooled data from all three years, while the density estimates were year-specific. The 2006 survey covered the largest portion of the habitat (10,676 km of trackline), from the 2000 m depth contour on the southern Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. The 2002 survey covered 7,465 km of trackline waters from the 1000-m depth contour on the southern Georges Bank to Maine; while the Bay of Fundy and Scotian shelf south of Nova Scotia was not surveyed. The 2004 survey covered the smallest portion of the habitat (6,180 km of trackline), from the 100-m depth contour on the southern Georges Bank to the lower Bay of Fundy; while the Scotian shelf south of Nova Scotia was not surveyed. No white-beaked dolphins were observed in the 2002 and 2004 abundance surveys.

Table 1. Summary of abundance estimates for western North Atlantic white-beaked 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
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	2,003	0.94

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 western North Atlantic stock of white-beaked dolphins is 2,003 (CV=0.94). The minimum population estimate for these white-beaked dolphins is 1,023.

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. 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 of white-beaked

dolphins is 1,023. 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 white-beaked dolphin is 10.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

White-beaked dolphins have been incidentally captured in cod traps and in the Canadian groundfish gillnet fisheries off Newfoundland and Labrador and in the Gulf of St. Lawrence (Alling and Whitehead 1987; Read 1994; Hai *et al.*1996). However, the total number of animals taken is not known. Of three bycaught white-beaked dolphins reported off Newfoundland during 1987-1988, 1 died in a groundfish gillnet, 1 in a herring gillnet, and 1 in a cod trap (Reeves *et al.*1999).

There are no documented reports of fishery-related mortality or serious injury to this stock in the U.S. EEZ. A white-beaked dolphin was captured by a Northeast bottom trawl in March 2003. However, since the animal was moderately decomposed and the trawl duration was short, the animal could not have died in this trawl.

Fishery Information

Because of the absence of observed fishery-related mortality and serious injury to this stock in the U.S. and Canadian waters, no fishery information is provided.

Other Mortality

White-beaked dolphins were hunted for food by residents in Newfoundland and Labrador (Alling and Whitehead 1987). These authors, based on interview data, estimated that 366 white-beaked dolphins were taken each year. The same authors reported that 25-50% of the killed dolphins were lost. Hunting that now occurs in Canadian waters is believed to be opportunistic and in remote regions of Labrador where enforcement of regulations is minimal (Lien *et al.*2001).

White-beaked dolphins regularly become caught in ice off the coast of Newfoundland during years of heavy pack ice. A total of 21 ice entrapments involving approximately 350 animals were reported in Newfoundland from 1979 to 1990; known mortality as a result of entrapment was about 55% (Lien *et al.*2001).

Mass strandings of white-beaked dolphins are less common than for white-sided dolphins. White-beaked dolphins more commonly strand as individuals or in small groups (Reeves *et al.*1999). In Newfoundland, 5 strandings of white-beaked dolphins occurred between 1979 and 1990 involving groups of 2 to 7 animals. On three occasions live dolphins came ashore, including groups of 3 and 4 (Reeves *et al.*1999).

White-beaked dolphin stranding records from 1997 onward that are part of the US NE Regional Office/NMFS strandings and entanglement database include six records that clearly identify the species to be the white-beaked dolphin (Table 2). Three of these strandings were collected from Cape Cod, Massachusetts beaches, where 1 animal stranded during May 1997, and 2 animals stranded during March 2001. A white-beaked dolphin also stranded in New York in February 2002. No white-beaked dolphins stranded during 2003. One white-beaked dolphin stranded in Maine during May 2004 and another stranded in Maine in June of 2005. It was not possible to determine the cause of death for any of the stranded animals.

Whales and dolphins stranded between 1997 and 2005 on the coast of Nova Scotia as recorded by the Marine Animal Response Society (MARS) and the Nova Scotia Stranding Network are as follows: 1 white-beaked dolphin stranded in May 1997, 0 documented strandings in 1998 to 2001, 2 in 2002 (1 in July (released alive) and 1 in August), and 0 in 2003, 2004 and 2005 (Table 2).

Table 2. Summary of number of stranded white-beaked dolphins during January 1, 2001 to December 31, 2005, by year and area within U.S. and Canada.

Area	Year					Total
	2001	2002	2003	2004	2005	
Maine				1	1	2
Massachusetts	2					2
New York		1				1
TOTAL US	2	1	0	1	1	5
Nova Scotia ^a		2				
GRAND TOTAL	2	3	0	1	1	7

a. One animal that stranded in July 2002 was released alive.

STATUS OF STOCK

The status of white-beaked dolphins, relative to OSP, in U.S. Atlantic coast waters 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 documented U.S. fishery-related mortality and serious injury for this stock (0) is less than 10% of the calculated PBR (10.0) and, therefore, is considered to be insignificant and approaching zero mortality and serious injury rate. This is a non-strategic stock because the 2001-2005 estimated average annual human related mortality does not exceed PBR.

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ATLANTIC SPOTTED DOLPHIN (*Stenella frontalis*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Atlantic spotted dolphins are distributed in tropical and warm temperate waters of the western North Atlantic (Leatherwood *et al.* 1976). Their distribution ranges from southern New England, south through the Gulf of Mexico and the Caribbean to Venezuela (Leatherwood *et al.* 1976; Perrin *et al.* 1994). Atlantic spotted dolphins regularly occur in the inshore waters south of Chesapeake Bay and near the continental shelf edge and continental slope waters north of this region (Payne *et al.* 1984; Mullin and Fulling 2003). Sightings have also been made along the north wall of the Gulf Stream and warm-core ring features (Waring *et al.* 1992).

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin, *Stenella frontalis*, formerly *S. plagiodon*, and the pantropical spotted dolphin, *S. attenuata* (Perrin *et al.* 1987). The Atlantic spotted dolphin occurs in two forms which may be distinct sub-species (Perrin *et al.* 1987, 1994; Rice 1998): the large, heavily spotted form which inhabits the continental shelf and is usually found inside or near the 200 m isobath; and the smaller, less spotted island and offshore form which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Fulling *et al.* 2003; Mullin and Fulling 2003; Mullin and Fulling 2004). Where they co-occur, the offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea.

A genetic analysis of mtDNA and microsatellite DNA data from samples collected in the Gulf of Mexico and the western North Atlantic reveal significant genetic differentiation between these areas (Adams and Rosel 2006). The western North Atlantic population is provisionally being considered a separate stock from the Gulf of Mexico stock(s) for management purposes. Adams and Rosel (2006) also provide evidence for genetic separation of dolphins within the western North Atlantic into two stocks with a provisional point of differentiation near Cape Hatteras, NC. These two Atlantic stocks, however, are not currently recognized as distinct management units, and thus will be treated as one western North Atlantic stock for the remainder of this assessment.

POPULATION SIZE

Total numbers of Atlantic spotted dolphins off the U.S. or Canadian Atlantic coast are unknown, although estimates are available from selected regions for select time periods. Sightings have been concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic (Fig. 1). The best recent abundance estimate for Atlantic spotted dolphins is the sum of the estimates from the two 2004 western U.S. Atlantic surveys. This joint estimate ($3,578+47,400=50,978$) is considered best because these two surveys together have the most complete coverage of the species' habitat.

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

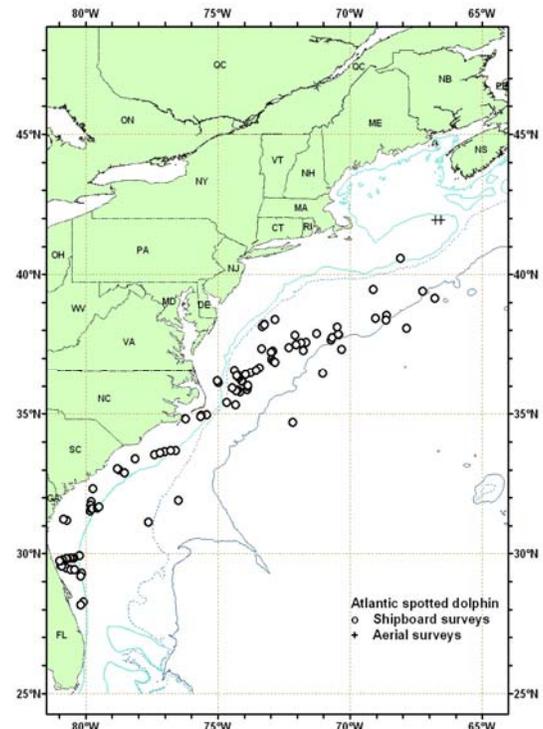


Figure 1. Distribution of Atlantic spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.

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

Earlier abundance estimates

An abundance estimate of 6,107 undifferentiated spotted dolphins (CV=0.27) was obtained from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance estimate of 4,772 (CV=1.27) undifferentiated spotted dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (NMFS unpublished data). An abundance estimate of 32,043 (CV=1.39) Atlantic spotted dolphins was derived from a line-transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N). An abundance estimate of 14,438 (CV=0.63) Atlantic spotted dolphins was generated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An abundance estimate of 3,578 (CV= 0.48) Atlantic spotted dolphins was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38°N) to the Bay of Fundy (45°N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and $g(0)$, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for $g(0)$ and biases due to school size and other potential covariates (Palka 2005).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥ 50 m) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the Mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias $g(0)$ and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for Atlantic spotted dolphins between Florida and Maryland was 47,400 animals (CV=0.45)(Table 1).

Table 1. Summary of abundance estimates for the western North Atlantic spotted dolphins, <i>Stenella frontalis</i> , by 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
Jun-Aug 2004	Maryland to the Bay of Fundy	3,578	0.48
Jun-Aug 2004	Florida to Maryland	47,400	0.45
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	50,978	0.42

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 abundance estimate is 50,978 (CV=0.42). The minimum population estimates based on the combined abundance estimates is 36,235.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Atlantic spotted dolphin is 36,235. 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 set to 0.5 because this stock is of unknown status. PBR for the combined offshore and coastal forms of Atlantic spotted dolphins is 362.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

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

Earlier Interactions

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

Forty-nine undifferentiated spotted dolphin mortalities were observed in the drift gillnet fishery between 1989 and 1998 and occurred northeast of Cape Hatteras within the 183m isobath in February-April and near Lydonia Canyon in October. Six whole animal carcasses sent to the Smithsonian were identified as pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), no fishery in 1997 and 0 in 1998.

Pelagic Longline

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

Table 2. Summary of the incidental mortality and serious injury of undifferentiated spotted dolphins (*Stenella frontalis* and *Stenella attenuata*) 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 observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels ^a	Data Type ^b	Observer Coverage ^c	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality ^d	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Pelagic Longline (excluding NED-E) ^h	01-05	98, 87, 63, 60, 60	Obs. Data Logbook	.04, .05, .09, .09, .06	0, 0, 1, 0, 0	0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 1, 0, 0	6 (1)
TOTAL											6 (1)

a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
 b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).

Other Mortality

From 2001-2005, 16 Atlantic spotted dolphins were stranded between Massachusetts and Puerto Rico (NMFS unpublished data). Two animals stranded in North Carolina and 3 in Florida in 2001; 2 animals stranded in North Carolina and 2 in Florida in 2002; 1 animal stranded in 2003 in Massachusetts, North Carolina, and Florida; one dolphin stranded in Florida and one in Puerto Rico in 2004; and one dolphin stranded in North Carolina and one in Georgia in 2005. None of these strandings had documented signs of fishery or human interactions.

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.

Table 2. Atlantic spotted dolphin (*Stenella frontalis*) reported strandings along the U.S. Atlantic coast, 2001-2005.

STATE	2001	2002	2003	2004	2005	TOTALS
Massachusetts	0	0	1	0	0	1
North Carolina	2	2	1	0	1	6
Georgia	0	0	0	0	1	1
Florida	3	2	1	1	0	7
Puerto Rico	0	0	0	1	0	1
TOTALS	5	4	3	2	2	16

STATUS OF STOCK

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

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin *et al.* 1987; Perrin and Hohn 1994). There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin, *Stenella frontalis*, formerly *S. plagiodon*, and the pantropical spotted dolphin, *S. attenuata* (Perrin *et al.* 1987). The Atlantic spotted dolphin occurs in two forms which may be distinct sub-species (Perrin *et al.* 1987, Perrin and Hohn 1994; Rice 1998): the large, heavily spotted form which inhabits the continental shelf and is usually found inside or near the 200-m isobath; and the smaller, less spotted island and offshore form which occurs in the Atlantic Ocean but is not known to occur in the Gulf of Mexico (Fulling *et al.* 2003; Mullin and Fulling 2003; Mullin and Fulling 2004). Where they co-occur, the offshore form of the Atlantic spotted dolphin and the pantropical spotted dolphin can be difficult to differentiate at sea

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

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

POPULATION SIZE

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

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

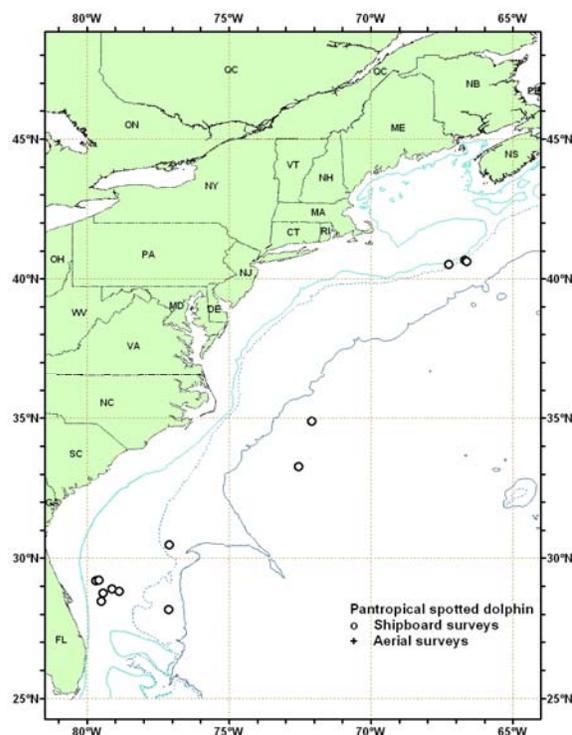


Figure 1. Distribution of pantropical spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m isobaths.

ranges.

Earlier abundance estimates

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

Recent surveys and abundance estimates

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

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥ 50 m) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the Mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias $g(0)$ and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for pantropical spotted dolphins between Florida and Maryland was 4,439 animals (CV=0.49)(Table 1).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to the Bay of Fundy	0	0
Jun-Aug 2004	Florida to Maryland	4,439	0.49
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	4,439	0.49

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for pantropical spotted dolphins is 4,439 (CV=0.49). The minimum population estimate for pantropical spotted dolphins is 3,010.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

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

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

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

Earlier Interactions

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

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

Pelagic Longline

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

Table 2. Summary of the incidental mortality and serious injury of undifferentiated spotted dolphins (<i>Stenella frontalis</i> and <i>Stenella attenuata</i>) 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 observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).											
Fishery	Years	Vessels ^a	Data Type ^b	Observer Coverage ^c	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality ^d	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Pelagic Longline (excluding NED-E) ^h	01-05	98, 87, 63, 60, 60	Obs. Data Logbook	.04, .05, .09, .09, .06	0, 0, 1, 0, 0	0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 0, 0, 0	0, 0, 30, 0, 0	0, 0, 1, 0, 0	6 (1)
TOTAL											6 (1)
<p>a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.</p> <p>b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).</p>											

Other Mortality

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

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

Table 3. Pantropical spotted dolphin (<i>Stenella attenuata</i>) reported strandings along the U.S. Atlantic coast, 2001-2005.						
STATE	2001	2002	2003	2004	2005	TOTALS
South Carolina	0	0	0	1 ^a	0	1
Florida	1	1	0	0	0	2
TOTALS	1	1	0	1	0	3
^a One pantropical spotted dolphin stranded in September in South Carolina and was considered part of the North Carolina Unusual Mortality Event.						

STATUS OF STOCK

The status of pantropical spotted dolphins, relative to OSP in the western U.S. Atlantic EEZ is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual human-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock

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STRIPED DOLPHIN (*Stenella coeruleoalba*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The striped dolphin, *Stenella coeruleoalba*, is distributed worldwide in warm-temperate to tropical seas (Archer and Perrin 1997). Striped dolphins are found in the western North Atlantic from Nova Scotia south to at least Jamaica and in the Gulf of Mexico. In general, striped dolphins appear to prefer continental slope waters offshore to the Gulf Stream (Leatherwood *et al.* 1976; Perrin *et al.* 1994; Schmidly 1981). There is very little information concerning striped dolphin stock structure in the western North Atlantic (Archer and Perrin 1997).

In waters off the northeastern U.S. coast, striped dolphins are distributed along the continental shelf edge from Cape Hatteras to the southern margin of Georges Bank, and also occur offshore over the continental slope and rise in the Mid-Atlantic region (CETAP 1982; Mullin and Fulling 2003; Figure 1). Continental shelf edge sightings in this program were generally centered along the 1,000 m depth contour in all seasons (CETAP 1982). During 1990 and 1991 cetacean habitat-use surveys, striped dolphins were associated with the Gulf Stream north wall and warm-core ring features (Waring *et al.* 1992). Striped dolphins seen in a survey of the New England Sea Mounts (Palka 1997) were in waters that were between 20° and 27°C and deeper than 900 m.

Although striped dolphins are considered to be uncommon in Canadian Atlantic waters (Baird *et al.* 1997), recent summer sightings (2-125 individuals) in the deeper and warmer waters of the Gully (submarine canyon off eastern Nova Scotia shelf) suggest that this region may be an important part of their range (Gowans and Whitehead 1995; Baird *et al.* 1997).

POPULATION SIZE

Total numbers of striped dolphins off the U.S. or Canadian Atlantic coast are unknown, although several estimates from selected regions are available for select time periods. Sightings are almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 1). The best abundance estimate for striped dolphins is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 94,462 (CV=0.40), where the estimate from the northern U.S. Atlantic is 52,055 (CV=0.57), and from the southern U.S. Atlantic is 42,407 (CV=0.53). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Earlier abundance estimates

An abundance estimate of 36,780 striped dolphins (CV=0.27) was obtained from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). Abundance estimates of 25,939 (CV=0.36) and 13,157 (CV=0.45) striped dolphins were obtained from line-transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11 aircraft (NMFS 1991). An abundance estimate of 31,669 (CV=0.73) striped dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence. An abundance estimate of 49,945 (CV=0.40) striped dolphins was obtained from the sum of the estimate of 39,720 (CV=0.45) striped dolphins from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38°N) (Palka 2006), and the estimate of 10,225 (CV=0.91) striped dolphins, estimated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003). As recommended in the GAMS Workshop Report (Wade and Angliss 1997),

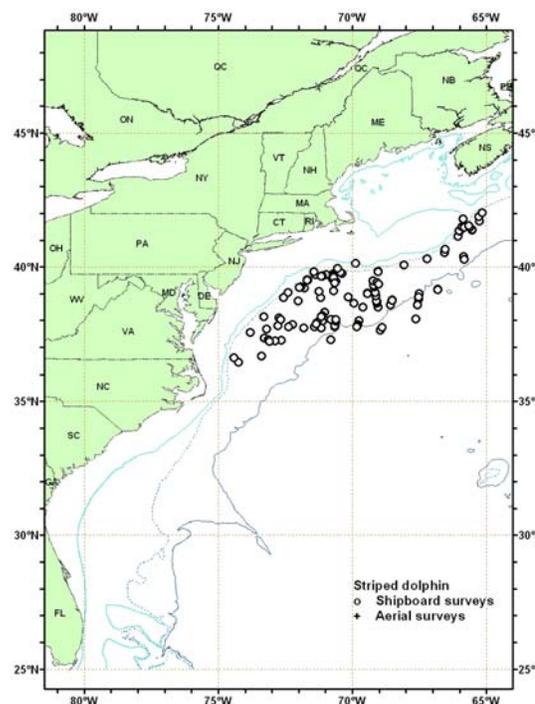


Figure 1. Distribution of striped dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer 1998, 1999, and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.

estimates older than eight years are deemed unreliable, and 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

Recent surveys and abundance estimates

An abundance estimate of 52,055 (CV=0.57) striped dolphins was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38°N) to the Bay of Fundy (45°N) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and $g(0)$, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for $g(0)$ and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38°N) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream Front in the Mid-Atlantic. The survey included 5,659 km of trackline, and there were a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias ($g(0)$) and group-size bias and analyzed using line-transect distance analysis (Palka 1995, 2006; Buckland *et al.* 2001). The resulting abundance estimate for striped dolphins between Florida and Maryland was 42,407 animals (CV=0.53).

Table 1. Summary of abundance estimates for western North Atlantic striped 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
Jun-Aug 2004	Maryland to the Bay of Fundy	52,055	0.57
Jun-Aug 2004	Florida to Maryland	42,407	0.53
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	94,462	0.40

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 striped dolphins is 94,462 (CV=0.40) obtained from the 2004 surveys. The minimum population estimate for the western North Atlantic striped dolphin is 68,558.

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. 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 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 68,558. 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 0.5 because this stock is of unknown status. PBR for the western North Atlantic striped dolphin is 686.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality to this stock during 2001-2005 was zero striped dolphins.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

The pelagic drift gillnet fishery is now closed. Forty striped dolphin mortalities were observed between 1989 and 1998 and occurred east of Cape Hatteras in January and February, and along the southern margin of Georges Bank in summer and autumn (Northridge 1996). Estimated annual mortality and serious injury (CV in parentheses) attributable to the pelagic drift gillnet fishery were 39 striped dolphins in 1989 (0.31), 57 in 1990 (0.33), 11 in 1991 (0.28), 7.7 in 1992 (0.31), 21 in 1993 (0.11), 13 in 1994 (0.06), 2 in 1995 (0), 7 in 1996 (CV=0.22), no fishery in 1997 and 4 in 1998 (CV=0).

In the North Atlantic bottom trawl fishery the only reported fishery-related mortalities (two) occurred in 1991, where the total estimated mortality and serious injury attributable to this fishery for 1991 was 181 (CV=0.97).

USA

Bycatch has previously been observed by NMFS Fisheries Observer Program in the pelagic drift gillnet and North Atlantic bottom trawl fisheries (see above) but no mortalities or serious injuries have recently been documented in any U.S. fishery.

CANADA

No mortalities were documented in review of Canadian gillnet and trap fisheries (Read 1994). However, in a recent review of striped dolphins in Atlantic Canada two records of incidental mortality have been reported (Baird *et al.* 1997) In the late 1960's and early 1970's two mortalities each, were reported in trawl and salmon net fisheries.

Between January 1993 and December 1994, 36 Spanish deep-water trawlers, covering 74 fishing trips (4,726 fishing days and 14,211 sets), were observed in NAFO Fishing Area 3 (off the Grand Bank) (Lens 1997). A total of 47 incidental catches were recorded, which included two striped dolphins. The incidental mortality rate for striped dolphins was 0.014/set.

Other Mortality

From 1995-1998, 7 striped dolphins were stranded between Massachusetts and Florida (NMFS unpublished data). From 1999-2003, fifty-nine dolphins were reported stranded from Maine to Florida (NMFS unpublished data). There were no signs of human interactions or mass strandings. The number of reported strandings per year were 2005 (16, including 12 from a mass stranding in North Carolina), 2004 (2), 2003 (19), 2002 (5), 2001 (9), 2000 (5), and 1999 (5).

In eastern Canada, 10 strandings were reported off eastern Canada from 1926-1971, and 19 from 1991-1996 (Sergeant *et al.* 1970; Baird *et al.* 1997; Lucas and Hooker 1997). In both time periods, most of the strandings were on Sable Island, Nova Scotia. Two stranding mortalities were reported in Nova Scotia in 2004 and two in 2005.

STATUS OF STOCK

The status of striped 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 the population trends for this species. The total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR, therefore can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual human-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock.

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FRASER'S DOLPHIN (*Lagenodelphis hosei*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Fraser's dolphins are distributed worldwide in tropical waters (Perrin *et al.* 1994) and are assumed to be part of the cetacean fauna of the tropical western North Atlantic. The paucity of sightings is probably due to naturally low abundance compared to other cetacean species. Sightings in the more extensively surveyed northern Gulf of Mexico are uncommon but occur on a regular basis. Fraser's dolphins have been observed in oceanic waters (>200 m) in the northern Gulf of Mexico during all seasons (Leatherwood *et al.* 1993; Hansen *et al.* 1996; Mullin and Hoggard 2000; Mullin and Fulling 2004). The western North Atlantic population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The numbers of Fraser's dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. A group of an estimated 250 Fraser's dolphins was sighted in waters 3300 m deep in the western North Atlantic off Cape Hatteras during a 1999 vessel survey (Figure 1; NMFS 1999). Abundance has not been estimated from the 1999 vessel survey in western North Atlantic because the sighting was not made during line-transect sampling effort; therefore, the population size of Fraser's dolphins is unknown. No Fraser's dolphins have been observed in any other surveys.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for this stock.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

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 history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal level (PBR) is the product of the 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 unknown. 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 Fraser's dolphin stock is unknown because the minimum population size is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related

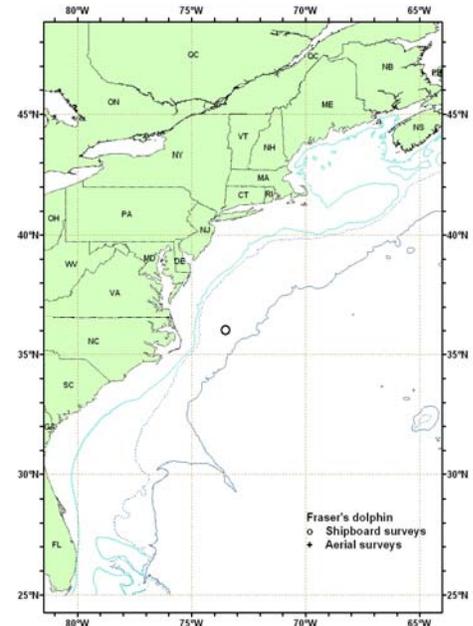


Figure 1. Distribution of Fraser's dolphins from SEFSC shipboard survey during 1999. Isobaths are at 100 m, 1,000 m, and 4,000 m.

mortality and serious injury to this stock during 2001-2005 was zero, as there were no reports of mortality or serious injury to Fraser's dolphins.

Other Mortality

From 2001-2005, 12 Fraser's dolphins were reported stranded between Maine and Puerto Rico (Table 1). The total includes one animal stranded in 2002, 10 mass stranded live animals in April 2003 in Lee, Florida, and one animal stranded in Florida in 2004. Prior to this time period, one animal stranded in Puerto in 1999. There were no indications of fishery or human interactions for these stranded animals.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

STATE	2001	2002	2003	2004	2005	TOTALS
Florida	0	0	10 ^a	1	0	11
Puerto Rico	0	1	0	0	0	1
TOTALS	0	1	10	1	0	12

^a Florida live mass stranding of 10 animals in Lee, Florida on April 4, 2003

STATUS OF STOCK

The status of Fraser's dolphins relative to OSP in the U.S. western North 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 size or trends and PBR cannot be calculated for this stock. No fishery-related mortality and serious injury has been observed since 1999; therefore, total U.S. fishery-related mortality and serious injury rate can be considered insignificant and approaching zero mortality and serious injury. This is not a strategic stock.

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CLYMENE DOLPHIN (*Stenella clymene*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Clymene dolphin is endemic to tropical and sub-tropical waters of the Atlantic (Jefferson and Curry 2003). Clymene dolphins have been commonly sighted in the Gulf of Mexico since 1990 (Mullin *et al.* 1994; Fertl *et al.* 2003), and a Gulf of Mexico stock has been designated since 1995. Four Clymene dolphin groups were sighted during summer 1998 in the western North Atlantic (Mullin and Fulling 2003), and two groups were sighted in the same general area during a 1999 bottlenose dolphin survey (NMFS unpublished). These sightings and stranding records (Fertl *et al.* 2003) indicate that this species routinely occurs in the western North Atlantic. The western North Atlantic population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The numbers of Clymene dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this species since it was rarely seen in any surveys.

Clymene dolphins were observed during earlier surveys along the U.S. Atlantic coast. Estimates of abundance were derived through the application of distance sampling analysis (Buckland *et al.* 2001) and the computer program DISTANCE (Thomas *et al.* 1998) to sighting data. Data were collected using standard line-transect techniques conducted from NOAA Ship *Relentless* during July and August 1998 between Maryland (38.00°N) and central Florida (28.00°N) from the 10 m isobath to the seaward boundary of the U.S. EEZ. Transect lines were placed perpendicular to bathymetry in a double saw-tooth pattern. Sightings of Clymene dolphins were primarily on the continental slope east of Cape Hatteras, North Carolina (Fig. 1). The best estimate of abundance for the Clymene dolphin was 6,086 (CV=0.93) (Mullin and Fulling 2003) and represents the first and only estimate to date for this species in the U.S. Atlantic EEZ. No Clymene dolphins have been observed in subsequent surveys. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations.

Minimum Population Estimate

No minimum population estimate is available at this time.

Current Population Trend

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

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 history

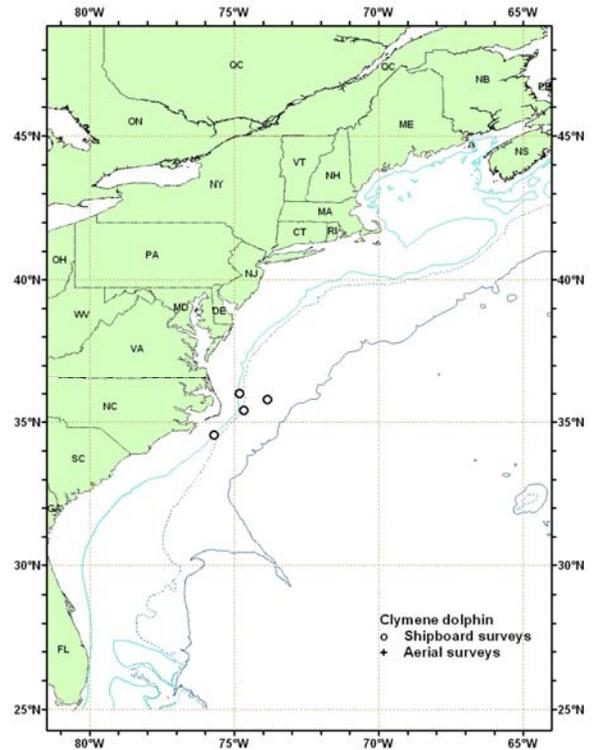


Figure 1. Distribution of Clymene dolphin sightings from NEFSC and SEFSC vessel and aerial summer surveys during 1998. Isobaths are at 100 m, 1,000 m, and 4,000 m.

(Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one half the maximum net productivity rate, and a recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown; therefore, PBR for the western North Atlantic Clymene dolphin stock is undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated fishery-related mortality and serious injury to this stock during 2001-2005 was zero, as there were no reports of mortalities or serious injury to Clymene dolphins.

Other Mortality

There has been one reported stranding of a Clymene dolphin in the western North Atlantic between 2001-2005, which occurred in NC in August 2004. This stranding was part of the Mid-Atlantic Offshore Small Cetacean UME, which was declared when 33 small cetaceans stranded from Maryland to Georgia between July-September 2004. One Clymene dolphin was involved in this UME.

Prior to this, one stranding of a Clymene dolphin was recorded in Florida in 1999. No sign of fishery or human interactions were noted. There may be some uncertainty in the identification of this species due to similarities with other *Stenella* species.

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.

STATUS OF STOCK

The status of Clymene dolphins, relative to OSP, in the 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 stock. Because there are insufficient data to calculate PBR it is not possible to determine if stock is strategic and if the total U.S. fishery-related mortality and serious injury for this stock is significant and approaching zero mortality and serious injury rate. However, because there are no documented takes in U.S. waters, this stock has been designated as not strategic.

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SPINNER DOLPHIN (*Stenella longirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Spinner dolphins are distributed in oceanic and coastal tropical waters (Leatherwood *et al.* 1976). This is presumably an offshore, deep-water species (Schmidly 1981; Perrin and Gilpatrick 1994), and its distribution in the Atlantic is very poorly known. In the western North Atlantic, these dolphins occur in deep water along most of the U.S. coast south to the West Indies and Venezuela, including the Gulf of Mexico. Spinner dolphin sightings have occurred exclusively in deeper (>2,000 m) oceanic waters (CETAP 1982; Waring *et al.* 1992; NMFS unpublished data) off the northeast U.S. coast. Stranding records exist from North Carolina, South Carolina, Florida and Puerto Rico in the Atlantic and in Texas and Florida in the Gulf of Mexico. The western North Atlantic population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The numbers of spinner dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock since it was rarely seen in any of the surveys.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

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 is unknown. 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 spinner dolphin is unknown because the minimum population size is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to this stock during 2001-2005 was zero, as there were no reports of mortalities or serious injury to spinner dolphins.

EARLIER INTERACTIONS

There was no documentation of spinner dolphin mortality or serious injury in distant-water fleet (DWF) activities off the northeast U.S. coast (Waring *et al.* 1990). No takes were documented in a review of Canadian gillnet and trap fisheries (Read 1994).

Bycatch has been observed in the now prohibited pelagic drift gillnet fishery, and in the pelagic longline fishery (one dolphin hooked and released alive without serious injury in 1997) but no mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast sink gillnet, Mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries (Yeung 1999).

Pelagic Drift Gillnet

One spinner dolphin mortality was observed in the pelagic driftnet between 1989 and 1993 and occurred east of Cape Hatteras in March 1993 (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. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 0.7 in 1989 (1.00), 1.7 in 1990 (1.00), 0.7 in 1991 (1.00), 1.4 in 1992 (0.31), 0.5 in 1993 (1.00) and zero from 1994-1996. This fishery is no longer in operation.

Other Mortality

From 2001-2005, 10 spinner dolphins were reported stranded between Maine and Puerto Rico (Table 1). The total includes 2 animals stranded in North Carolina in 2001, 2 animals stranded in Puerto Rico in 2002, 4 mass stranded live animals in December 2003 in Flagler, Florida (all died on the scene), 1 animal stranded in Florida 2003 and in 2004. There were no indications of fishery or human interactions for these stranded animals.

Stranding data probably underestimate the extent of fishery-related mortality and serious injury because all of the marine mammals that die or are seriously injured may not wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery-interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interaction.

STATE	2001	2002	2003	2004	2005	TOTALS
North Carolina	2	0	0	0	0	2
South Carolina	0	0	0	0	0	0
Georgia	0	0	0	0	0	0
Florida	0	0	5 ^a	1	0	6
Puerto Rico	0	2	0	0	0	2
TOTALS	2	2	5	1	0	10

^a Includes live mass stranding of 4 animals in Flagler, FL in December 2003.

STATUS OF STOCK

The status of spinner dolphins, relative to OSP, in the U.S. western North 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 size or trends and PBR cannot be calculated for this stock. No fishery-related mortality and serious injury has been observed since 1999; therefore, total fishery-related mortality and serious injury rate can be considered insignificant and approaching zero mortality and serious injury. This is not a strategic stock.

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HOODED SEAL (*Cystophora cristata*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The hooded seal occurs throughout much of the North Atlantic and Arctic Oceans (King 1983) preferring deeper water and occurring farther offshore than harp seals (Sergeant 1976a; Campbell 1987; Lavigne and Kovacs 1988; Stenson *et al.* 1996). The world's hooded seal population has been divided by ICES into three separate stocks, each identified with a specific breeding site (Lavigne and Kovacs 1988; Stenson *et al.* 1996): Northwest Atlantic, Greenland Sea ("West Ice"), and White Sea ("East Ice"). The Western North Atlantic stock (synonymous with the ICES Northwest Atlantic stock), whelps off the coast of eastern Canada and is divided into three whelping areas. The Front herd (largest) breeds off the coast of Newfoundland and Labrador, Gulf herd breeds in the Gulf of St. Lawrence, and the third area is in the Davis Strait.

Hooded seals are highly migratory and may wander as far south as Puerto Rico (Mignucci-Giannoni and Odell 2001), with increased occurrences from Maine to Florida. These appearances usually occur between January and May in New England waters, and in summer and autumn off the southeast U.S. coast and in the Caribbean (McAlpine *et al.* 1999; Harris *et al.* 2001; Mignucci-Giannoni and Odell 2001). Although it is not known which stock these seals come from, it is known that during spring, the northwest Atlantic stock of hooded seals are at their southernmost point of migration in the Gulf of St. Lawrence. Hooded seals remain on the Newfoundland continental shelf during winter/spring (Stenson *et al.* 1996). Breeding occurs at about the same time in March for each stock. Three of 4 hooded seals stranded, satellite tagged, and released in the United States in 2004 migrated to the eastern edge of the Scotian Shelf and the two that were monitored until June ended up on the southeast tip of Greenland. The fourth traveled into the Gulf of St. Lawrence. (WHALENET at <http://whale.wheelock.edu>). Adults from all stocks assemble in the Denmark Strait to molt between late June and August (King 1983; ICES 1995), and following this, the seals disperse widely. Some move south and west around the southern tip of Greenland, and then north along the west coast of Greenland. Others move to the east and north between Greenland and Svalbard during late summer and early fall (Lavigne and Kovacs 1988). Little else is known about the activities of hooded seals during the rest of the year until they assemble again in February for breeding.

POPULATION SIZE

The number of hooded seals in the western North Atlantic is relatively well known and is derived from pup production estimates produced from whelping pack surveys. Several estimates of pup production at the Front are available. Hooded seal pup production between 1966 and 1977 was estimated at 25,000 - 32,000 annually (Benjaminsen and Oritsland 1975; Sergeant 1976b; Lett 1977; Winters and Bergflodt 1978; Stenson *et al.* 1996). Estimated pup production dropped to 26,000 hooded seal pups in 1978 (Winters and Bergflodt 1978). Pup production estimates began to increase after 1978, reaching 62,400 (95% CI. 43,700 - 89,400) by 1984 (Bowen *et al.* 1987, ICES 2006). Bowen *et al.* (1987) also estimated pup production in the Davis Strait at 19,000 (95% C.I. 14,000 - 23,000). A 1985 survey at the Front (Hay *et al.* 1985) produced an estimate of 61,400 (95% C.I. 16,500 - 119,450). Hammill *et al.* (1992) estimated the Front pup production to be 83,100 (SE=12,700) in 1990. Assuming a ratio of pups to total population of 1:5, pup production in the Gulf and Front herds would represent a total population of approximately 400,000-450,000 hooded seals (Stenson 1993). Based on the 1990 survey, Stenson *et al.* (1996) suggested that pup production may have increased at about 5% per year since 1984. However, because of exchange between the Front and the Davis Strait stocks, the possibility of a stable or slightly declining level of pup production was also likely (Stenson 1993; Stenson *et al.* 1996). In 1998 and 1999, surveys were conducted to estimate pup production in the southern Gulf of St. Lawrence, which is the smallest component of the northwest Atlantic stock (ICES 2001). The estimate of 2,000 was similar to the previous published 1990 estimate (Hammill *et al.* 1992; ICES 2001). Surveys of all three whelping areas in the Northwest Atlantic were carried out in 2005. Pup production at the Front was estimated to be 107,013 (SE=7,558, CV=7.1%) while 6,620 (SE=1,700, CV=25.8%) pups were estimated to have been born in the Gulf and 3,346 (SE=2,237, CV=66.8%) in Davis Strait. Total pup production in the northwest Atlantic was 116,900 (SE=7,918, CV=6.8%). Fitting pup production estimates from all herds and making assumptions about numbers of hooded seals in the Davis Strait herd for years when this area was not included in the survey program, results in an estimate of total population in 2005 of 592,100 (SE=94,800; 95% C.I.= 404,400-779,800).

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 western North Atlantic hooded seals is 592,100 (SE=94,800). The minimum population estimate based on the 2005 pup survey results is 512,000. Present data are insufficient to calculate the minimum population estimate for U.S. waters.

Current population trend

Comparison with previous estimates suggests that pup production (and total population size) may have increased since the mid 1980s but the considerable uncertainty about the relationship among whelping areas makes it difficult to reliably assess the population trend.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The most appropriate data are based on Canadian studies, which assume the maximum net productivity rate to be 0.12 (ICES 2006). This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% 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 512,000. The maximum productivity rate is 0.12, the default value for pinnipeds. The recovery factor (F_R) for this stock is set at 0.75, the value for populations which are thought to be increasing. PBR for the western North Atlantic hooded seal stock is 15,360 but for U.S. waters is unknown. The Joint NAFO/ICES Harp and Hooded Seal Working Group applied the PBR formula to Canadian population estimates to obtain a harvest reference level of 19,650 and 23,025 hooded seals from the Front Only and All Areas, respectively (ICES 2006).

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period 2001-2005, the total estimated human caused mortality and serious injury to hooded seals was 5,199. This is derived from three components: 1) an average catch of 5,173 seals from 2001-2005 (2001= 3,960; 2002 = 7,341; 2003 = 5,446, 2004 = 5,270, and 2005 = 3,846) average catches of Northwest Atlantic population of hooded seals by Canada and Greenland (ICES 2006); 2) 25 hooded seals (CV=0.82) from the observed U.S. fisheries (Table 1); and 3) one hooded seal from average 2001-2005 non-fishery related, human interaction stranding mortalities (NMFS unpublished data). Note that there is considerable intermixing between the Northwest Atlantic and West Ice stocks, so it is possible that Northwest Atlantic seals are taken by Greenland sealers.

Fishery Information

Detailed fishery information is reported in Appendix III.

U.S.

Northeast Sink Gillnet

The fishery has been observed in the Gulf of Maine and in southern New England. There were 2 hooded seal mortalities observed in the Northeast sink gillnet fishery between 1990 and 2005. The bycatch in 2001 occurred in summer (July-September). All bycatch was in waters between Cape Ann and New Hampshire. Annual estimates of hooded seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996). Estimated annual mortalities (CV in parentheses) from this fishery during 1990-2003 were 0 in 1990-1994, 28 in 1995 (0.96), 0 in 1996-2000, 82 in 2001 (1.14), 0 in 2002-2003, 43 (0.95) in 2004, and 0 in 2005. The 1995 bycatch includes 5 animals from the estimated number of unknown seals (based on observed mortalities of seals that could not be identified to species). The unknown seals were prorated, based on spatial/temporal patterns of bycatch of harbor seals, gray seals, harp seals, and hooded seals. There were 8, 2, 2, 9, and 14 unidentified seals observed during 2001-2005, respectively. Since 1997, unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2001-

2005 was 25 hooded seals (CV=0.82) (Table 1).

CANADA

An unknown number of hooded seals have been taken in Newfoundland and Labrador groundfish gillnets (Read 1994).

Hooded seals are being taken in Canadian lumpfish and groundfish gillnets and trawls; however, estimates of total removals have not been calculated to date.

Table 1. Summary of the incidental mortality of hooded seal (<i>Cystophora cristata</i>) 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 ^a	Observer Coverage ^b	Observed Mortality ^c	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet	01-05	unk	Obs. Data, Weighout, Logbooks	.04, .02, .03, .06, .07	1, 0, 0, 1, 0	82, 0, 0, 43, 0	1.14, 0, 0, .95, 0	25 (0.82)
TOTAL								25 (0.82)

^a Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Science Center Observer 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 determine the spatial distribution of some fishing effort in the Northeast sink gillnet fishery.

^b The observer coverages for the Northeast sink gillnet fishery are ratios based on tons of fish landed.

^c Only mortalities observed on marine mammal trips were used to estimate total hooded seal bycatch. See Bisack (1997) for "trip" type definitions. The one hooded seal mortality observed in 2001 was taken in a net equipped with pingers. The one hooded seal mortality observed in 2004 was taken in a net not equipped with pingers.

Other Mortality

In Atlantic Canada, hooded seals have been commercially hunted at the Front since the late 1800's. In 1974 total allowable catch (TAC) was set at 15,000, and reduced to 12,000 in 1983 and to 2,340 in 1984 (Stenson 1993; Anonymous 1998). From 1991 to 1992 the TAC was increased to 15,000. A TAC of 8,000 was set for 1993, and held at that level through 1997. From 1974 through 1982, the average catch was 12,800 animals, mainly pups. Since 1983 catches ranged from 33 in 1986 to 6,425 in 1991, with a mean catch of 1,001 between 1983 and 1995. Catches peaked in 1996 (25,754) due to good ice conditions and strong market demand (ICES 1998). Since 1996 catches have fallen markedly and during 2000-2004 averaged 170 animals per year (ICES 2006). A series of management regulations have been implemented for the Canadian harvest since 1960. For example, the taking of bluecoats was prohibited in 1993 and the TAC has been set at 10,000 seals per year since 1998 (ICES 2006).

In 1988-1993, strandings were fewer than 20 per year, and from 1994 to 1996 they increased to about 50 per year (Rubinstein 1994; Rubinstein, pers. comm.). From 2001 to 2005, 138 hooded seal stranding mortalities were reported in most states from Maine to North Carolina (Table 3; NMFS unpublished data). Six (4.3%) of the mortalities during this five year period showed signs of human interaction (2 in 2001, 1 in 2004 and 3 in 2005), with one animal having some indication of fishery interaction (1 in 2004). Extralimital strandings have also been reported off the southeast U.S., North Carolina to Florida, and in the Caribbean (McAlpine *et al.* 1999; Mignucci-Giannoni and Odell 2001; NMFS, unpublished data). Harris and Gupta (2006) analyzed NMFS 1996-2002 stranding data and suggest that the distribution of hooded seal stranding in the Gulf of Maine is consistent with the species seasonal migratory patterns in this region.

Table 3. Hooded seal (<i>Cystophora cristata</i>) stranding mortalities along the U.S. Atlantic coast (2001-2005) ^a .						
State	2001	2002	2003	2004 ^a	2005 ^b	Total
ME	21	8	5	6	3	43
NH		1	1	1		3
MA	22	8	3	9	11	53
RI	2					2
CT	1					1
NY	10	1		1	4	16
NJ	5	1	1	1		8
DE	1	1		2		4
MD				1		1
VA	1				1	2
NC	5					5
Total	68	20	10	21	19	138
Unspecified seals (all states)	37	35	27	33	59	191
a. Some of the data reported in this table differ from that reported in previous years. We have reviewed the records and made an effort to standardize reporting. Live releases and rehabbed animals have been eliminated						

STATUS OF STOCK

The status of hooded seals relative to OSP in U.S. Atlantic EEZ is unknown, but the stock's abundance appears to be increasing. The species not listed as threatened or endangered under the Endangered Species Act. The total U.S. fishery-related mortality and serious injury for this stock is very low relative to the stock's size and can be considered insignificant and approaching zero mortality and serious injury rate. Because the level of human-caused mortality and serious injury is also low relative to overall stock size, this is not a strategic stock.

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