

SEI WHALE (*Balaenoptera borealis*): Nova Scotia Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Indications are that, at least during the feeding season, a major portion of the Northwest Atlantic sei whale population is centered in northerly waters, perhaps on the Scotian Shelf (Mitchell and Chapman 1977). The southern portion of the species' range during spring and summer includes the northern portions of the U.S. Atlantic Exclusive Economic Zone (EEZ) - the Gulf of Maine and Georges Bank. The period of greatest abundance there is in spring, with sightings concentrated along the eastern margin of Georges Bank and into the Northeast Channel area, and along the southwestern edge of Georges Bank in the area of Hydrographer Canyon (CETAP 1982). NMFS aerial surveys in 1999, 2000 and 2001 found concentrations of sei and right whales along the Northern Edge of Georges Bank in the spring. The sei whale is often found in the deeper waters characteristic of the continental shelf edge region (Hain et al. 1985), and NMFS aerial surveys found substantial numbers of sei whales in this region, south of Nantucket, in the spring of 2001. Similarly, Mitchell (1975) reported that sei whales off Nova Scotia were often distributed closer to the 2,000 m depth contour than were fin whales.

This general offshore pattern of sei whale distribution is disrupted during episodic incursions into more shallow and inshore waters. Although known to take piscine prey, sei whales (like right whales) are largely planktivorous, feeding primarily on euphausiids and copepods. In years of reduced predation on copepods by other predators, and thus greater abundance of this prey source, sei whales are reported in more inshore locations, such as the Great South Channel (in 1987 and 1989) and Stellwagen Bank (in 1986) areas (R.D. Kenney, pers. comm.; Payne et al. 1990). An influx of sei whales into the southern Gulf of Maine occurred in the summer of 1986 (Schilling et al. 1993). Such episodes, often punctuated by years or even decades of absence from an area, have been reported for sei whales from various places worldwide.

Based on analysis of records from the Blandford, Nova Scotia, whaling station, where 825 sei whales were taken between 1965 and 1972, Mitchell (1975) described two "runs" of sei whales, in June-July and in September-October. He speculated that the sei whale population migrates from south of Cape Cod and along the coast of eastern Canada in June and July, and returns on a southward migration again in September and October; however, such a migration remains unverified.

Mitchell and Chapman (1977) reviewed the sparse evidence on stock identity of northwest Atlantic sei whales, and suggested two stocks - a Nova Scotia stock and a Labrador Sea stock. The range of the Nova Scotia stock includes the continental shelf waters of the northeastern U.S., and extends northeastward to south of Newfoundland. The Scientific Committee of the IWC, while adopting these general boundaries, noted that the stock identity of sei whales (and indeed all North Atlantic whales) was a major research problem (Donovan 1991). In the absence of evidence to the contrary, the proposed IWC stock definition is provisionally adopted, and the "Nova Scotia stock" is used here as the management unit for this stock assessment. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia, thence east to longitude 42° W.

POPULATION SIZE

The total number of sei whales in the U.S. Atlantic EEZ is unknown. However, two abundance estimates are available for portions of the sei whale habitat: from Nova Scotia during the 1970s, and in the U.S. Atlantic EEZ during the springs of 1979-1981.

Mitchell and Chapman (1977), based on tag-recapture data, estimated the Nova Scotia, Canada, stock to contain between 1,393 and 2,248 sei whales. Based on census data, they estimated a minimum Nova Scotian population of 870 sei whales.

An abundance of 280 sei 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). The estimate is based on data collected during the spring when the greatest proportion of the population off the northeast U.S. coast appeared in the study area. This estimate does not include a correction for dive-time or $g(0)$, the probability of detecting an animal group on the track line. The CETAP report suggested, however, that correcting the estimated abundance for dive time would increase the estimate to approximately the same as Mitchell and Chapman's (1977) tag-

recapture estimate. This estimate is more than 20 years out of date and thus almost certainly does not reflect the current true population size; in addition, the estimate has a high degree of uncertainty (i.e., it has a large CV), and it was estimated just after cessation of extensive foreign fishing operations in the region. There are no recent abundance estimates for the sei whale.

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). A current minimum population size cannot be estimated because there are no current abundance estimates (within the last 10 years).

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. 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 0.10 because the sei whale is listed as endangered under the Endangered Species Act (ESA). PBR for the Nova Scotia stock of the sei whale is unknown because the minimum population size is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There was no reported fishery-related mortality or serious injury to sei whales in fisheries observed by NMFS during 1999-2003. A review of NMFS stranding and entanglement records from 1999 through 2003 yielded an average of 0.4 human-caused mortalities per year as a result of two ship strikes. The carcass of a 13-meter female was recovered on May 2, 2001, in New York harbor after it slid off the bow of an arriving ship. Freshness of the carcass and hemorrhaging around the dorsal impact area indicated the strike was pre-mortem. The second record within the period was an 11-meter male discovered February 19, 2003, outside of Norfolk Naval Base in Norfolk, VA. A large gash into muscle tissue extended from behind dorsal midline on left side almost all the way around to the ventral midline on the right sides through blubber layer and into some muscle. Histopathology results supported perimortem trauma. The only other NMFS record of a human-caused sei whale mortality was from November 17, 1994, when a sei whale carcass was observed on the bow of a container ship as it docked in Boston, Massachusetts.

Fishery Information

There have been no reported entanglements or other interactions between sei whales and commercial fishing activities; therefore there are no descriptions of fisheries.

STATUS OF STOCK

The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown, but the species is listed as endangered under the ESA. There are insufficient data to determine the population trends for sei whales. The total level of human-caused mortality and serious injury is unknown, but the rarity of mortality reports for this species suggests that this level is insignificant and approaching a zero mortality and serious injury rate. This is a strategic stock because the sei whale is listed as an endangered species under the ESA. A Recovery Plan for sei whales has been written and is awaiting legal clearance.

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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. 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 2003). 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). 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 2003). Off the northeast U.S., CETAP and NMFS/NEFSC sightings in shelf-edge and off-shelf waters included many social

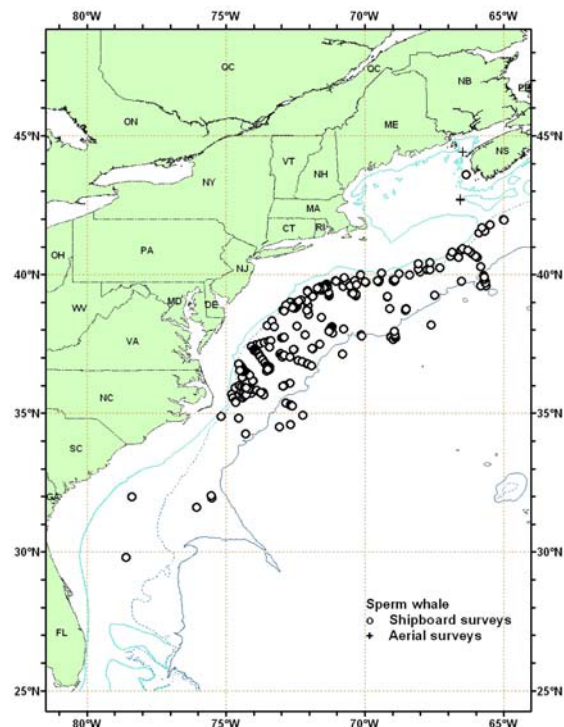


Figure 1. Distribution of sperm whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, 1999 and 2004. Isobaths are 100 m, 1,000 m, and 4,000 m.

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.

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). 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 2,000m 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). 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.

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

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). Data were collected by two alternating teams that searched with 25x150 binoculars and an independent observer who searched by naked eye from a separate platform on the bow. Data were analyzed using DISTANCE (Buckland *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

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 *et al.* Unpubl. Ms.). Total track line length was 32,600 km. The ships covered waters between the 50 and 1,000 fathom isobaths, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the Mid-Atlantic from the coastline to the 50 fathom isobath, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1,000 fathom isobath. Data collection and analysis methods used were described in 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) (Figure 1; Table 1; Palka *et al.* Unpubl. Ms.). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 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) (Figure 1; Mullin and Fulling 2003). This estimate is a recalculation of the same data reported in previous SARs. For more details see Mullin and Fulling (2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993) where school size bias and ship attraction were accounted for.

The best 1998 abundance estimate for sperm whales is the sum of the estimates from the two U.S. Atlantic surveys, 4,029 (CV=0.38), where the estimate from the northern U.S. Atlantic is 2,848 (CV=0.49) and from the southern U.S. Atlantic is 1,181 (CV=0.51). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

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 (38°N) to the Bay of Fundy (45°N) (Figure 1; Palka Unpub. Ms.). 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 (Figure 1; Palka unpub.).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38°N) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x 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).

The best 2004 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; Peter Madsen, Woods Hole Oceanographic Institution, pers. comm.), 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.

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
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	2,848	0.49
Jul-Aug 1998	Florida to Maryland	1,181	0.51
Jul-Sep 1998	Florida to Gulf of St. Lawrence (COMBINED)	4,029	0.38
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	Florida to Bay of Fundy (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 7.0.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During 1999-2003, human caused mortality was 0.4 sperm whales per year (CV=unknown). This is derived from three components: 0 sperm whales per year (CV=unknown) from U.S. fisheries using observer data; 0.2 sperm whales based on the 2000 stranding of a sperm whale off Florida which had fishing gear in its blow hole; 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 nmi 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 1904-1972 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), Faroes, and British coastal. 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 2003, ten sperm whale strandings were documented along the U.S. Atlantic coast 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 nine animals.

STATE	2001	2002	2003	TOTAL
Massachusetts	1	1	--	1
North Carolina	--	--	2	2
South Carolina	--	1	--	1
Florida	--	2	2	4
EEZ	1 ^a	--	--	1
TOTAL	2	4	4	9

^a U.S. Navy reported ship strike

In eastern Canada, 5 dead strandings were reported in Newfoundland/Labrador in 1987-1995; 13 dead strandings along Nova Scotia in 1988-1996; 7 dead strandings on Prince Edward Island in 1988-1991; 2 dead strandings in Quebec in 1992; 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 1999-2003, 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. In addition, during 1999-2003, one sperm whale was a confirmed fishery interaction, thus, there is an annual average of 0.2 sperm whales taken in U.S. fisheries.

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 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.

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DWARF SPERM WHALE (*Kogia sima*): Western North Atlantic Stock 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). There are no stranding records for the east Canadian coast (Willis and Baird 1998). Sightings of these animals in the western North Atlantic occur in oceanic waters (Mullin and Fulling 2003; NMFS unpublished data). 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. There is no information on stock differentiation for the Atlantic population. 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. Diagnostic morphological characters have also 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).

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*.

An abundance of 115 (CV=0.61) for *Kogia* sp. was estimated from a line-transect survey conducted from 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) (Fig. 1; Palka *et al.*, Unpubl. Ms.). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 580 (CV=0.57) for *Kogia* sp. 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) (Fig. 1; Mullin and Fulling 2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 2001; Thomas *et al.* 1998).

An abundance of 358 (CV= 0.44) for *Kogia* sp. was estimated 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) (Figure 1; Palka unpublished). 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 (Figure 1; Palka unpublished).

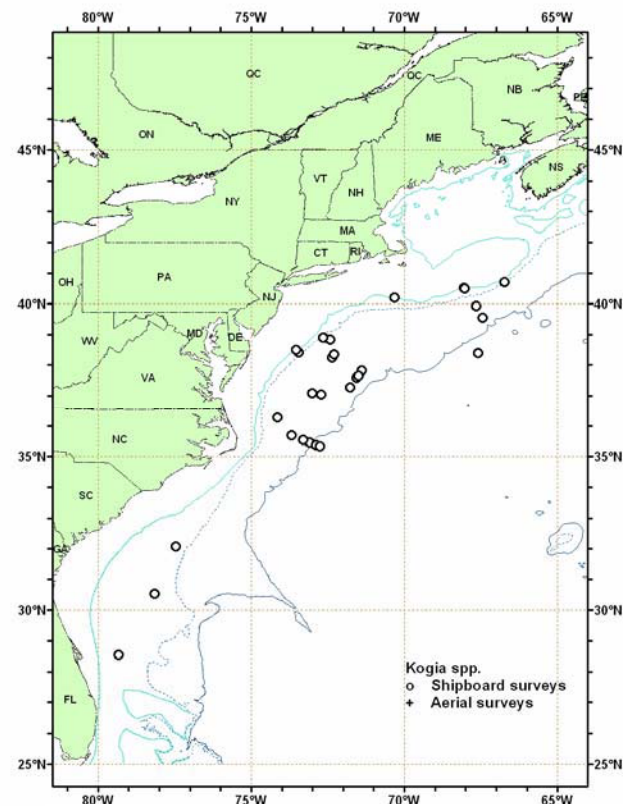


Figure 1. Distribution of *Kogia* sp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m and 4,000 m.

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths $\geq 50\text{m}$) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x 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 *Kogia* sp. between Florida and Maryland was 37 (CV=0.75).

The best 2004 abundance estimate for *Kogia* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 395 (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 together these two surveys have the most complete coverage of the species' habitat. A separate estimate of dwarf sperm whale abundance cannot be provided due to the uncertainty of species identification at sea.

Month/Year	Area	N_{best}	CV
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	115	0.61
Jul-Aug 1998	Florida to Maryland	580	0.57
Jul-Sep 1998	Florida to Gulf of St. Lawrence (COMBINED)	695	0.49
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.

Current Population Trend

The available information is insufficient to evaluate trends in population size 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 (Wade and Angliss 1997). The minimum population size 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. There has been no logbook report of fishery- related serious injury recorded off the east coast of Florida in the pelagic longline fishery in 2000 (Table 2) (Yeung 2001; Garrison 2003; Garrison and Richards, 2004). Total annual estimated average fishery-related mortality and serious injury to this stock

during 1999-2003 was zero for dwarf sperm whales, as there were no reports of mortality or serious injury to dwarf sperm whales (Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Earlier Interactions

No dwarf sperm whale mortalities were observed in 1977-1991 foreign fishing activities. Bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet fishery, but no mortalities or serious injuries have been documented in other fisheries.

There was one report of mortality or serious injury to a dwarf sperm whale attributable to the pelagic drift gillnet fishery. Estimated annual fishery-related mortality and serious injury (CV in parentheses) was 0 dwarf sperm whales from 1991-1994, 1.0 in 1995 (CV=0), and 0 from 1996-2003.

Other Mortality

From 1999-2003, 37 dwarf sperm whales were reported stranded between North Carolina and Puerto Rico (Table 2). No dwarf sperm whales were reported to stranded in Nova Scotia from 1990-2004 (T. Wimmer, Nova Scotia Marine Animal Response Society, pers. comm.). The total includes 8 animals stranded in North Carolina and 1 in Georgia in 1999; 4 animals stranded in North Carolina, 1 in South Carolina, and 4 in Florida in 2000; 1 animal stranded in North Carolina, 1 in South Carolina, and 2 in Florida in 2001; 3 animals stranded in Florida and 2 in Puerto Rico in 2002; and 4 animals stranded in North Carolina, 2 in South Carolina, 2 in Georgia, and 2 in Florida in 2003. In addition to the above strandings of *Kogia sima*, there were 8 strandings reported as *Kogia* sp. as follows: 1 *Kogia* sp. stranded in Georgia in 2000, 1 stranded in North Carolina and 2 in Florida in 2002, and 1 stranded in Georgia and 3 in Florida in 2003.

STATE	1999	2000	2001	2002	2003	TOTALS
North Carolina	8	4	1 ^a	0 ^a	4	17
South Carolina	0	1	1	0	2	4
Georgia	1	0 ^a	0	0 ^a	2 ^a	3
Florida	0	4	2	3 ^b	2 ^c	11
Puerto Rico	0	0	0	2	0	2
TOTALS	9	9	4	5	10	37

^a1 additional *Kogia* sp. stranded
^b2 additional *Kogia* sp. stranded
^c3 additional *Kogia* sp. stranded

There were no documented strandings of dwarf sperm whales along the U.S. Atlantic coast during 1999- 2003 which were classified as likely caused by fishery interactions.

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 this area. 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.

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 the dwarf sperm whale relative to OSP in the western U.S. Atlantic EEZ is unknown. This species is not listed as endangered or threatened under the Endangered Species Act. There is insufficient information with which to assess population trends. Total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock.

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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). Sightings of these animals in the western North Atlantic occur in oceanic waters (Mullin and Fulling 2003; SEFSC unpublished data). 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. There is no information on stock differentiation for the Atlantic population. 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. Diagnostic morphological characters have also 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).

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*.

An abundance of 115 (CV=0.61) for *Kogia* sp. was estimated from a line-transect survey conducted from 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) (Fig. 1; Palka *et al.* in review Unpubl. Ms.). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 580 (CV=0.57) for *Kogia* sp. 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) (Fig. 1; Mullin and Fulling 2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 2001; Thomas *et al.* 1998).

An abundance of 358 (CV= 0.44) for *Kogia* sp. was estimated 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) (Figure 1; Palka unpublished). 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 (Figure 1; Palka unpublished).

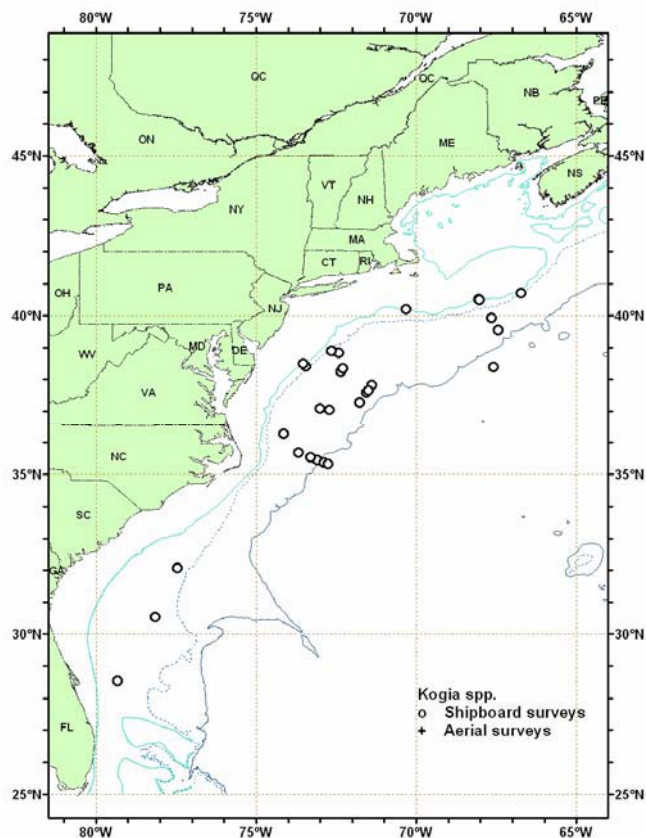


Figure 1. Distribution of *Kogia* sp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m and 4,000 m.

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths $\geq 50\text{m}$) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x 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 was 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 *Kogia* sp. between Florida and Maryland was 37 (CV=0.75).

The best 2004 abundance estimate for *Kogia* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 395 (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 together these two surveys have the most complete coverage of the species' habitat. A separate estimate of pygmy sperm whale abundance cannot be provided due to the uncertainty of species identification at sea.

Month/Year	Area	N_{best}	CV
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	115	0.61
Jul-Aug 1998	Florida to Maryland	580	0.57
Jul-Sep 1998	Florida to Gulf of St. Lawrence (COMBINED)	695	0.49
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 (CV=0.40). The minimum population estimate for *Kogia* sp. is 285.

Current Population Trend

The available information is insufficient to evaluate trends in population size 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 (Wade and Angliss 1997). The minimum population size 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 0.4 because the coefficient of variation for the mortality estimate was greater than 0.8. 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. There has been one logbook report of fishery- related serious injury recorded off the east coast of Florida in the pelagic longline fishery in 2000 (Table 2) (Yeung 2001; Garrison 2003; Garrison and Richards, 2004). Total annual estimated average fishery-related mortality and serious injury to this stock during 1999-2003 was 6 (CV=1.0) *Kogia* sp.

Table 2. Summary of the incidental mortality and serious injury of pygmy sperm whales (*Kogia breviceps*) 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 ^c	Data Type ^a	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality
Pelagic Longline ^b	99-03	198, 180, 161, 149, 127	Obs. Data Logbook	.04, .04, .02, .04, .02	0, 0, 1, 0, 0	0, 0, 0, 0, 0	0, 0, 28, 0, 0	0, 0, 0, 0, 0	0, 0, 28 ² , 0, 0	0, 0, 1, 0, 0	6 (1.0)
TOTAL											6 (1.0)

^a Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Southeast Fisheries Science Center (SEFSC) Observer Program. NEFSC collects landings data (Weighout), and total landings are used as a measure of total effort for the coastal gillnet fishery. Observed bycatch rates are raised to total fishing effort reported to the SEFSC Atlantic Large Pelagic Logbook.

^b The 2000 mortality estimates were taken from Table 10 in Yeung 2001, and exclude the Gulf of Mexico.

^c Number of vessels in the fishery are based on vessels reporting effort to the pelagic longline logbook.

Other Mortality

From 1999-2003, 125 pygmy sperm whales were reported stranded between Maine and Puerto Rico (Table 3). The total includes 7 animals stranded in Florida in 1999; 3 animals stranded in North Carolina, 1 in South Carolina, 7 in Florida and 1 in Puerto Rico in 2000; 1 animal stranded in North Carolina, 4 in South Carolina, 3 in Georgia, and 24 in Florida in 2001; 7 animals stranded in North Carolina, 5 in South Carolina, 4 in Georgia, and 15 in Florida in 2002; and 1 animal stranded in Nova Scotia, 4 animals in North Carolina, 7 in Georgia, and 31 in Florida in 2003. In addition to the above strandings of *Kogia breviceps*, there were 8 strandings reported as *Kogia* sp. as follows: 1 *Kogia* sp. stranded in Georgia in 2000, 1 stranded in North Carolina and 2 in Florida in 2002, 1 stranded in Georgia and 3 in Florida in 2003.

Table 3. Pygmy sperm whale (*Kogia breviceps*) strandings along the Atlantic coast, 1999-2003

STATE	1999	2000	2001	2002	2003	TOTALS
Nova Scotia ^a					1	1
North Carolina	0	3	1 ^{b,c}	7 ^c	4	15
South Carolina	0	1	4	5	0	10
Georgia	0	0 ^c	3	4 ^c	7 ^c	14
Florida	7 ^b	7	24	15 ^d	31 ^e	84
Puerto Rico	0	1 ^b	0	0	0	1
TOTALS	7	12	32	31	43	125

^a Data supplied by Tonya Wimmer, Nova Scotia Marine Animal Response Society (pers. comm.)

^b Signs of human interaction reported

^c 1 additional *Kogia* sp. stranded

^d 2 additional *Kogia* sp. stranded

^e 3 additional *Kogia* sp. stranded

There were 3 documented strandings of pygmy sperm whales along the U.S. Atlantic coast during 1999- 2003 which were classified as likely caused by fishery interactions., 1 in Florida in 1999, 1 in Puerto Rico in 2000 and 1 in North Carolina in 2001. 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 the pygmy sperm whale relative to OSP in the western U.S. Atlantic EEZ is unknown. This species is not listed as endangered or threatened under the Endangered Species Act. There is insufficient information with which to assess population trends. Total fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because the 1999-2003 estimated average annual fishery-related mortality to pygmy sperm whales exceeds PBR.

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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 (Anon. 1999; Anon. 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 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 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 1999-2003 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). There has historically been some take of this species in small cetacean fisheries in the Caribbean (Caldwell and Caldwell 1971).

Other Mortality

From 1999-2003, 2 pygmy killer whales were reported stranded between Maine and Puerto Rico (Table 1). The total includes 1 animal stranded in South Carolina and 1 in Georgia in 2003, 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.

STATE	1999	2000	2001	2002	2003	TOTALS
North Carolina	0	0	0	0	0	0
South Carolina	0	0	0	0	1	1
Georgia	0	0	0	0	1	1
Florida	0	0	0	0	0	0
Puerto Rico	0	0	0	0	0	0
TOTALS	0	0	0	0	2	2

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 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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CUVIER'S BEAKED WHALE (*Ziphius cavirostris*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of Cuvier's beaked whales is poorly known, and is based mainly on stranding records (Leatherwood *et al.* 1976). Strandings have been reported from Nova Scotia along the eastern U.S. coast south to Florida, around the Gulf of Mexico, and within the Caribbean (Leatherwood *et al.* 1976; CETAP 1982; Heyning 1989; Houston 1990; Mignucci-Giannoni *et al.* 1999). Stock structure in the North Atlantic is unknown.

Cuvier's beaked whale sightings have occurred principally along the continental shelf edge in the Mid-Atlantic region off the northeast U.S. coast (CETAP 1982; Waring *et al.* 1992; Waring *et al.* 2001; Palka *et al.* Unpubl. Ms.). Most sightings were in late spring or summer.

POPULATION SIZE

The total number of Cuvier's beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown.

However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) 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). An abundance of 120 undifferentiated beaked whales ($CV=0.71$) 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 442 ($CV=0.51$) undifferentiated beaked 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 262 ($CV=0.99$) undifferentiated beaked 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 370 ($CV=0.65$) and 612 ($CV=0.73$) undifferentiated beaked whales was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (NMFS 1991). 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.

An abundance of 330 ($CV=0.66$) undifferentiated beaked 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). Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

An abundance of 99 ($CV=0.64$) undifferentiated beaked 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). Data were collected by two alternating teams that searched with 25x150 binoculars and an independent observer who searched by naked eye from a separate platform on the bow. Data were analyzed using

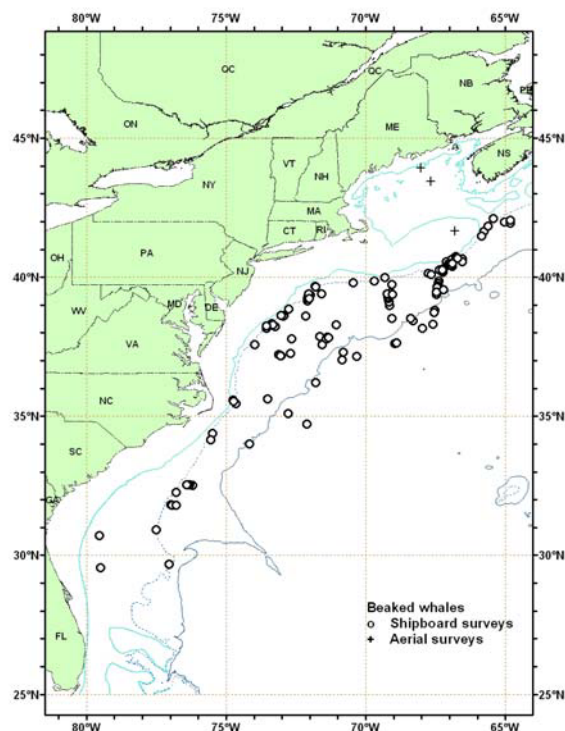


Figure 1. Distribution of beaked whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer 1998, 1999, and 2004. Isobaths are 100 m, 1,000 m, and 4,000 m.

DISTANCE (Buckland *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

An abundance of 1,519 (CV=0.69) undifferentiated beaked 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 *et al.* Unpubl. Ms.). Total track line length was 32,600 km. The ships covered waters between the 50 and 1,000 fathom isobaths, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the Mid-Atlantic from the coastline to the 50 f isobath, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1,000 f isobath. Data collection and analysis methods used were described in Palka (1996).

An abundance of 2,600 (CV=0.40) undifferentiated beaked 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) (Figure 1; Palka *et al.* Unpubl. Ms.). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 541 (CV=0.55) undifferentiated beaked 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) (Figure 1; Mullin and Fulling 2003). This estimate is a recalculation of the same data reported in previous SARs. For more details, see Mullin and Fulling (2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993) where school size bias and ship attraction were accounted for.

The best 1998 abundance estimate for undifferentiated beaked whales is the sum of the estimates from the two U.S. Atlantic surveys, 3,141 (CV=0.34), where the estimate from the northern U.S. Atlantic is 2,600 (CV=0.40) and from the southern U.S. Atlantic is 541 (CV=0.55). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

An abundance of 2,211 (CV=0.58) for beaked 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 (38°N) to the Bay of Fundy (45°N) (Figure 1; Palka unpubl.). 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 (Figure 1; Palka unpubl.).

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 latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x 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 beaked whales between Florida and Maryland was 674 (CV =0.36).

The best 2004 abundance estimate for beaked whales is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 3,513 (CV =0.63), where the estimate from the northern U.S. Atlantic is 2,839 (CV =0.78), and from the southern U.S. Atlantic is 674 (CV =0.36). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Although the 1990-2004 surveys did not sample exactly the same areas or encompass the entire beaked 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 beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. Recent results suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features.

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefers deep-water habitats (Mead 1989) the bias may be substantial.

Table 1. Summary of abundance estimates for the undifferentiated complex of beaked whales which include <i>Ziphius</i> and <i>Mesoplodon</i> spp. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).			
Month/Year	Area	N_{best}	CV
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	2,600	0.40
Jul-Aug 1998	Florida to Maryland	541	0.55
Jul-Sep 1998	Florida to Gulf of St. Lawrence (COMBINED)	3,141	0.34
Jun-Aug 2004	Maryland to the Bay of Fundy	2,839	0.78
Jun-Aug 2004	Florida to Maryland	674	0.36
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	3,513	0.63

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 undifferentiated beaked whales is 3,513 (CV = 0.63). The minimum population estimate for the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 2,154. It is not possible to determine the minimum population estimate of only Cuvier's beaked whales.

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. Life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity is 6.1m for females, and 5.5 m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mitchell 1975; Mead 1984; Houston 1990).

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 undifferentiated complex of beaked whales is 2,154. 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 all species in the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 22. It is not possible to determine the PBR for only Cuvier's beaked whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 1999-2003 total average estimated annual mortality of beaked whales in fisheries in the U.S. Atlantic EEZ was 1.0 and is derived from three components: 1) two stranded animals were entangled in fishing gear, 2) two animals were ship struck, and 3) one stranded animal died from acoustic or blunt trauma - see other mortality text and (Table 2).

Fishery Information

Detailed fishery information is reported in Appendix III.

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Earlier Interactions

There is no historical information available that documents incidental mortality of beaked whales in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October. Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included 24 Sowerby's, 4 True's, 1 Cuvier's and 17 undifferentiated beaked whales. Recent analyses of biological samples (genetics and morphological analysis) have been used to determine species identifications for some of the bycaught animals. Estimated bycatch mortality by species is available for the 1994-1998 period. Prior estimates are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). The 1994-1998 estimates by 'species' are:

Year	Cuvier's	Sowerby's	True's	<i>Mesoplodon</i> spp.
1994	1 (0.14)	3 (0.09)	0	0
1995	0	6 (0)	1 (0)	3 (0)
1996	0	9 (0.12)	2 (0.26)	2 (0.25)
1997	NA	NA	NA	NA
1998	0	2 (0)	2 (0)	7 (0)

During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part". Annual mortality estimates do not include any animals injured and released alive.

Other Mortality

From 1992 to 2000, a total of 53 beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). This includes: 28 (includes one tentative identification) Gervais' beaked whales (one 1997 animal had plastics in esophagus and stomach, and Sargassum in esophagus; 2 animals that stranded in September 1998 in South Carolina showed signs of fishery interactions); 2 True's beaked whales; 5 Blainville's beaked whales; 1 Sowerby's beaked whale; 13 Cuvier's beaked whales (one 1996 animal had propeller marks, and one 2000 animal had a longline hook in the lower jaw) and 4 unidentified animals.

One stranding of Sowerby's beaked whale was recorded on Sable Island between 1970-1998 (Lucas and Hooker 2000). The whale's body was marked by wounds made by the cookiecutter shark (*Isistius brasiliensis*), which has previously been observed on beaked whales (Lucas and Hooker 2000).

Also, several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with Naval activities. During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; Evans and England 2001; Cox *et al.*, in review). Four Cuvier's, 2 Blainville's and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsies of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.*, in review).

During 2001-2003, twenty-four beaked whales stranded along the U.S. Atlantic coast (Table 2).

STATE	2001	2002	2003	TOTAL
Maine		<i>M. mirus</i> (1)	<i>M. bidens</i> (1) ^c	2
Massachusetts	--	--	--	--
Virginia	--	<i>M. europaeus</i> (2) ^b	<i>M. mirus</i> (1) ^d	3
North Carolina	<i>M. europaeus</i> (1) <i>Mesoplodon</i> spp. (3)	Unid. (1)	<i>M. europaeus</i> (2) <i>Mesoplodon</i> spp. (1)	8
South Carolina	<i>M. europaeus</i> (2)	<i>Ziphius</i> (1)	<i>Ziphius</i> (2)	5
Florida	<i>M. europaeus</i> (4) ^a	--	<i>Ziphius</i> (1) <i>M. europaeus</i> (1)	6
Total	10	5	9	24 ^e

^a Acoustic or blunt trauma was the assigned cause of mortality for one animal stranded in Broward County in Sept.
^b Ship strike was the likely cause of death for one animal
^c Boat strike was the likely cause of death
^d Entanglement in fishing gear was the likely cause of death
^e The cause of death for most of the stranded animals could not be determined.

STATUS OF STOCK

The status of Cuvier's beaked whale relative to OSP in the U.S. Atlantic EEZ is unknown. This species is not listed as threatened or endangered under the Endangered Species Act. Although a species specific PBR cannot be determined, the permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality. The total fishery mortality and serious injury for this group is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because of uncertainty regarding stock size and evidence of human induced mortality and serious injury associated with acoustic activities.

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MESOPLODON BEAKED WHALES (*Mesoplodon* spp.): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Within the genus *Mesoplodon*, there are four species of beaked whales that reside in the northwest Atlantic. These include True's beaked whale, *Mesoplodon mirus*; Gervais' beaked whale, *M. europaeus*; Blainville's beaked whale, *M. densirostris*; and Sowerby's beaked whale, *M. bidens* (Mead 1989). These species are difficult to identify to the species level at sea; therefore, much of the available characterization for beaked whales is to genus level only. Stock structure for each species is unknown.

The distribution of *Mesoplodon* spp. in the northwest Atlantic is known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (CETAP, 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Palka *et al.* unpublished manuscript; Figure 1). Most sightings were in late spring and summer, which corresponds to survey effort.

True's beaked whale is a temperate-water species that has been reported from Cape Breton Island, Nova Scotia, to the Bahamas (Leatherwood *et al.* 1976; Mead 1989). It is considered rare in Canadian waters (Houston 1990).

Gervais' beaked whales are believed to be principally oceanic, and strandings have been reported from Cape Cod Bay to Florida, into the Caribbean and the Gulf of Mexico (Leatherwood *et al.* 1976; Mead 1989; NMFS unpublished data). This is the most common species of *Mesoplodon* to strand along the U.S. Atlantic coast. The northernmost stranding was on Cape Cod.

Blainville's beaked whales have been reported from southwestern Nova Scotia to Florida, and are believed to be widely but sparsely distributed in tropical to warm-temperate waters (Leatherwood *et al.* 1976; Mead 1989, Nicolas *et al.* 1993). There are two records of strandings in Nova Scotia which probably represent strays from the Gulf Stream (Mead 1989). They are considered rare in Canadian waters (Houston 1990).

Sowerby's beaked whales have been reported from New England waters north to the ice pack, and individuals are seen along the Newfoundland coast in summer (Leatherwood *et al.* 1976; Mead 1989). Furthermore, a single stranding occurred off the Florida west coast (Mead 1989). This species is considered rare in Canadian waters (Lien *et al.* 1990).

POPULATION SIZE

The total number of *Mesoplodon* spp. beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown.

However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) 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). An abundance of 120 (CV=0.71) undifferentiated beaked 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 442 (CV=0.51) undifferentiated beaked 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 262 (CV=0.99)

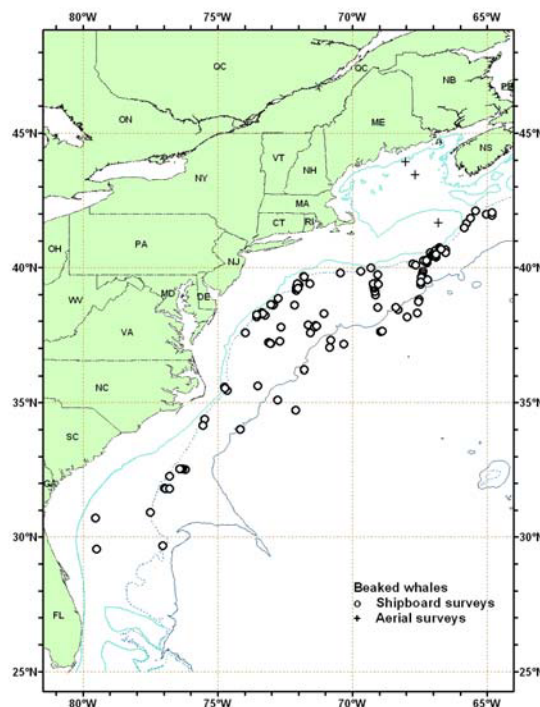


Figure 1. Distribution of beaked whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer 1998, 1999, and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.

undifferentiated beaked whales was estimated from a June and July 1991 shipboard line transect sighting survey conducted primarily between the 200 and 2,000m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998). Abundances of 370 (CV=0.65) and 612 (CV=0.73) undifferentiated beaked whales were estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (NMFS 1991). 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.

An abundance of 330 (CV=0.66) undifferentiated beaked whales was estimated from a June and July 1993 shipboard line transect sighting survey conducted principally between the 200 and 2,000m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (NMFS 1993). Data were collected by two alternating teams that searched with 25x150 binoculars and were analyzed using DISTANCE (Buckland *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

An abundance of 99 (CV=0.64) undifferentiated beaked 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 (Table 1; NMFS 1994). Data were collected by two alternating teams that searched with 25x150 binoculars and an independent observer who searched by naked eye from a separate platform on the bow. Data were analyzed using DISTANCE (Buckland *et al.* 1993). Estimates include school-size bias, if applicable, but do not include corrections for $g(0)$ or dive-time. Variability was estimated using bootstrap resampling techniques.

An abundance of 1,519 (CV=0.69) undifferentiated beaked 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 *et al.* unpublished manuscript). Total track line length was 32,600km. The ships covered waters between the 50 and 1000 fathom isobaths, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the Mid-Atlantic from the coastline to the 50 fathom isobath, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom isobath. Data collection and analysis methods used were described in Palka (1995).

An abundance of 2,600 (CV=0.40) undifferentiated beaked whales was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900km of track line in waters north of Maryland (38°N) (Figure 1; Palka *et al.* unpublished manuscript). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 541 (CV=0.55) for undifferentiated beaked whales was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163km of track line in waters south of Maryland (38°N) (Figure 1; Mullin and Fulling 2003). This estimate is a recalculation of the same data reported in previous SARs. For more details see Mullin and Fulling (2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993) where school size bias and ship attraction were accounted for.

The best 1998 abundance estimate for undifferentiated beaked whales is the sum of the estimates from the two U.S. Atlantic surveys, 3,141 (CV=0.34), where the estimate from the northern U.S. Atlantic is 2,600 (CV=0.40) and from the southern U.S. Atlantic is 541 (CV=0.55). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

An abundance of 2,211 (CV=0.58) for beaked whales was estimated 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) (Figure 1; Palka unpublished). 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 (Figure 1; Palka unpublished).

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southern U.S. Atlantic is 674 (CV =0.36). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Although the 1990-2004 surveys did not sample exactly the same areas or encompass the entire beaked 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 beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. Recent results suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features.

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefers deep-water habitats (Mead 1989) the bias may be substantial.

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Jul-Sep 1998	Gulf of St. Lawrence to Florida (COMBINED)	3,141	0.34
Jun-Aug 2004	Maryland to the Bay of Fundy	2,839	0.78
Jun-Aug 2004	Florida to Maryland	674	0.36
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	3,513	0.63

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 undifferentiated beaked whales is 3,513 (CV =0.63). The minimum population estimate for the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 2,154. It is not possible to determine the minimum population estimate of only *Mesoplodon* beaked whales.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3m, length at sexual maturity 6.1m for females, and 5.5m for males, maximum age for females were 30 growth layer groups (GLG's) and for males was 36 GLG's, which may be annual layers (Mead 1984).

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 undifferentiated complex of beaked whales is 2,154. 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 all species in the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 22. It is not possible to determine the PBR for only *Mesoplodon* beaked whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 1999-2003 total average estimated annual mortality of beaked whales in fisheries in the U.S. Atlantic EEZ was 1.0 and is derived from three components: 1) two stranded animals were entangled in fishing gear, 2) two animals were ship struck, and 3) one stranded animal died from acoustic or blunt trauma - see other mortality text and (Table 2).

Fishery Information

Total fishery-related mortality and serious injury cannot be estimated separately for each beaked whale species because of the uncertainty in species identification by fishery observers. The Atlantic Scientific Review Group advised adopting the risk-averse strategy of assuming that any beaked whale stock which occurred in the U.S. Atlantic EEZ might have been subject to the observed fishery-related mortality and serious injury.

Bycatch has been observed by NMFS sea samplers in the pelagic drift gillnet fishery, but no mortalities or serious injuries have been documented in the pelagic longline, pelagic trawl, Northeast sink gillnet, Mid-Atlantic coastal gillnet, or North Atlantic bottom trawl fisheries by NMFS sea samplers. Detailed fishery information is reported in Appendix III.

Earlier Interactions

There is no historical information available that documents incidental mortality in either U.S. or Canadian Atlantic coast fisheries (Read 1994). The only documented bycatch of beaked whales is in the pelagic drift gillnet fishery (now prohibited). The bycatch only occurred from Georges Canyon to Hydrographer Canyon along the continental shelf break and continental slope during July to October (Northridge 1996). Forty-six fishery-related beaked whale mortalities were observed between 1989 and 1998. These included: 24 Sowerby's; 4 True's; 1 Cuvier's; and 17 undifferentiated beaked whales. Recent analysis of biological samples (genetics and morphological analysis) have been used to determine species identifications for some of the bycaught animals. Estimates of bycatch mortality by species are available for the 1994-1998 period. Prior estimates are for undifferentiated beaked whales. The estimated annual fishery-related mortality (CV in parentheses) was 60 in 1989 (0.21), 76 in 1990 (0.26), 13 in 1991 (0.21), 9.7 in 1992 (0.24) and 12 in 1993 (0.16). The 1994-1998 estimates by 'species' are:

Year	Cuvier's	Sowerby's	True's	<i>Mesoplodon</i> spp.
1994	1 (0.14)	3 (0.09)	0	0
1995	0	6 (0)	1 (0)	3 (0)
1996	0	9 (0.12)	2 (0.26)	2 (0.25)
1997	NA	NA	NA	NA
1998	0	2 (0)	2 (0)	7 (0)

During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part". Annual mortality estimates do not include any animals injured and released alive.

Other Mortality

From 1992-2000, a total of 53 beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). This includes: 28 (includes one tentative identification) Gervais' beaked whales (one 1997 animal had plastics in esophagus and stomach, and Sargassum in esophagus; 2 animals that stranded in September 1998 in South Carolina showed signs of fishery interactions); 2 True's beaked whales; 5 Blainville's beaked whales; 1 Sowerby's beaked whale; 13 Cuvier's beaked whales (one 1996 animal had propeller marks, and one 2000 animal had a longline hook in the lower jaw) and 4 unidentified animals. One stranding of Sowerby's beaked whale was recorded on Sable Island between 1970-1998 (Lucas and Hooker 2000). The whale's body was marked by wounds made by the cookiecutter shark (*Isistius brasiliensis*), which has previously been observed on beaked whales (Lucas and Hooker 2000).

Also, several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with naval activities. During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whale and Blainville's beaked whale occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 was associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked

whales (5 Cuvier's and 1 Blainville's) died (Balcomb and Claridge 2001; Evans and England 2001; Cox *et al.*, in review). Four Cuvier's, 2 Blainville's, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown, since none of the whales have been resighted. Necropsy of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Cox *et al.*, in review).

During 2001-2003, twenty-four beaked whales stranded along the U.S. Atlantic coast (Table 2).

Table 2. Beaked whale (<i>Ziphius cavirostris</i> and <i>Mesoplodon</i> sp.) strandings along the U.S. Atlantic coast.				
State	2001	2002	2003	Total
Maine	0	<i>M. mirus</i> (1)	<i>M. bidens</i> (1) ^c	2
Massachusetts	0	--	0	0
Virginia	0	<i>M. europaeus</i> (2) ^b	<i>M. mirus</i> (1) ^d	3
North Carolina	<i>M. europaeus</i> (1) Mesoplodon sp. (3)	Unid. (1)	<i>M. europaeus</i> (2); <i>Mesoplodon</i> sp. (1)	9
South Carolina	<i>M. europaeus</i> (2)	<i>Ziphius</i> (1)	<i>Ziphius</i> (2)	5
Florida	<i>M. europaeus</i> (4) ^a	--	<i>Ziphius</i> (1); <i>M. europaeus</i> (1)	5
Total	10	5	9	24 ^e
^a Acoustic or blunt trauma was the assigned cause of mortality for one animal stranded in Broward County in Sept. ^b Ship strike was the likely cause of death for one animal ^c Boat strike was the likely cause of death ^d Entanglement in fishing gear was the likely cause of death ^e The cause of death for most of the stranded animals could not be determined.				

STATUS OF STOCK

The status of *Mesoplodon* beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. These species are not listed as threatened or endangered under the Endangered Species Act. Although a species specific PBR cannot be determined, the permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality. The total fishery mortality and serious injury for this group is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because of uncertainty regarding stock size and evidence of human induced mortality and serious injury associated with acoustic activities.

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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). Melon-headed 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 melon-headed whales in the northern Gulf of Mexico 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 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; Anon. 1999; Anon. 2002). Abundances have not been estimated from the 1999 and 2002 vessel surveys in western North Atlantic (NMFS 1999; NMFS 2002); 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).

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.

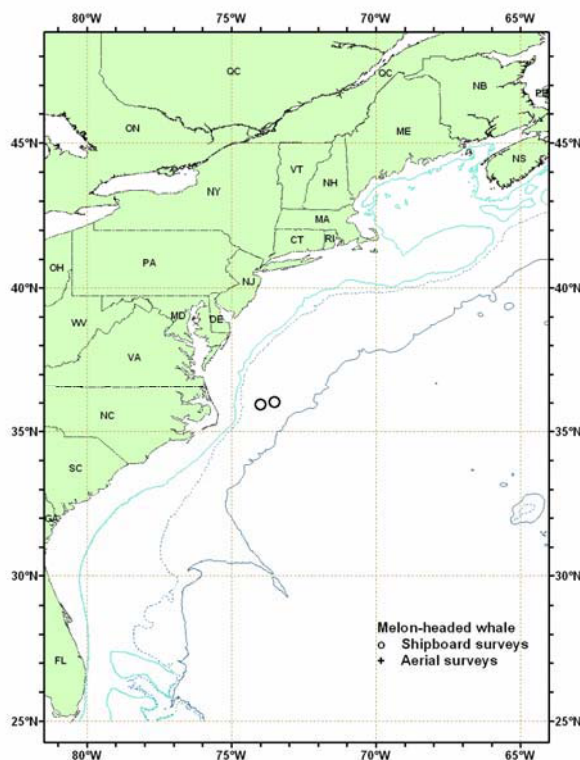


Figure 1. Distribution of melon-headed whales from SEFSC vessel surveys during 1998-2002. All sightings are shown. Solid lines indicate the 100 m, 1,000 m, and 4,000 m isobaths.

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 1999-2003 was zero melon-headed whales, as there were no reports of mortality or serious injury to melon-headed whales (Yeung 2001; Garrison 2003; Garrison and Richards, 2004).

Other Mortality

From 1999-2003, 1 melon-headed whale was reported stranded in Puerto Rico. There was one additional reported stranding of a melon-headed whale in the western North Atlantic between 1997 and 2002. No evidence of human interaction was apparent for either stranded animal.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

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 200m 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

Atlantic spotted dolphins are distributed in tropical and warm temperate waters of the western North Atlantic (Leatherwood *et al.* 1976). Their distribution is from southern New England, south through the Gulf of Mexico and the Caribbean to Venezuela (Leatherwood *et al.* 1976; Perrin *et al.* 1994). The large, heavily spotted form of the Atlantic spotted dolphin along the southeastern and Gulf coasts of the United States, which may warrant designation as a distinct sub-species (Rice 1998), inhabits the continental shelf, usually being found inside or near the 200 m isobath (within 250-350 km of the coast) but sometimes coming into very shallow water adjacent to the beach (Figure 1). Off the northeast U.S. coast, spotted dolphins are widely distributed on the continental shelf, along the continental shelf edge, and offshore over the deep ocean south of 40° N (CETAP 1982). 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). Stock structure in the western North Atlantic is unknown.

POPULATION SIZE

Total numbers of Atlantic spotted dolphins 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 *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. Sightings were concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras, with sightings extending into the deeper slope and offshore waters of the Mid-Atlantic (Fig. 1).

An abundance of 6,107 undifferentiated spotted dolphins (CV=0.27) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

An abundance of 4,772 (CV=1.27) undifferentiated spotted dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; Palka *et al.* Unpublished Manuscript). Total track line length was 32,600km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the

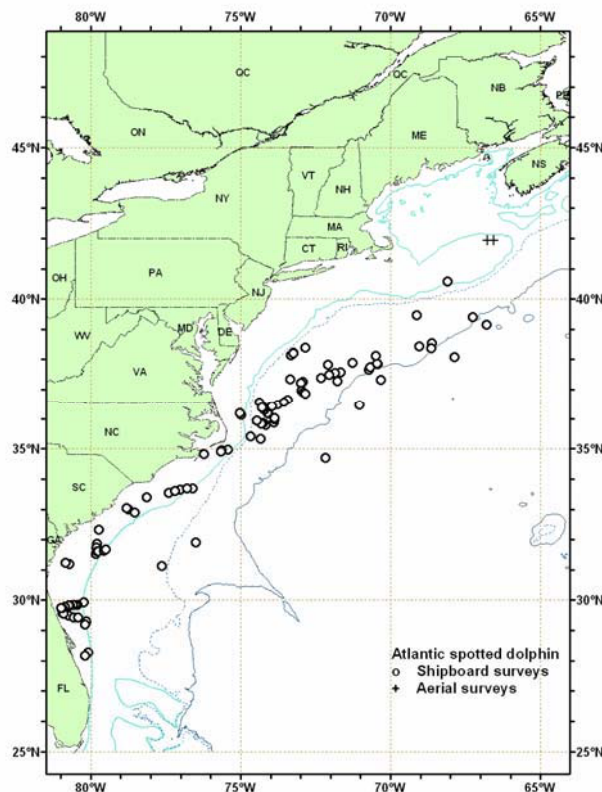


Figure 1. Distribution of Atlantic spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.

Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the Mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 32,043 (CV=1.39) for offshore Atlantic spotted dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* Unpublished Manuscript). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 14,438 (CV=0.63) for Atlantic spotted dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163km of track line in waters south of Maryland (38°N) (Figure 1; Mullin and Fulling 2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 2001) where school size bias and ship attraction were accounted for.

An abundance of 3,578 (CV= 0.48) for Atlantic spotted dolphins was estimated 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) (Figure 1; Palka unpublished manuscript). 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 (Figure 1; Palka Unpublished Manuscript).

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 50x 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 Atlantic spotted dolphins between Florida and Maryland was 47,400 (CV=0.45).

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' ranges. This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat. The best 2004 abundance estimate for Atlantic spotted dolphins is the sum of the estimates from the two 2004 western U.S. Atlantic surveys, 50,978 (CV=0.42), where the estimate from the northern U.S. Atlantic is 3,578 (CV=0.48), and from the southern U.S. Atlantic is 47,400 (CV=0.45).

Table 1. Summary of abundance estimates for both undifferentiated spotted dolphins (1995), and differentiated Atlantic spotted dolphins (1998 and 2004). Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	32,043 ^a	1.39
Jul-Aug 1998	Florida to Maryland	14,438 ^c	0.63
Jul-Sep 1998	Florida to Gulf of St. Lawrence (COMBINED)	46,481 ^b	0.98
Jun-Aug 2004	Maryland to 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 ^b	0.42

^a This represents the first estimate for the offshore Atlantic spotted dolphin.

^b This is the combined estimate for the two survey regions

^c This estimate is a recalculation of the same data reported in previous SARs. For more details see Mullin and Fulling 2003.

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 offshore and coastal abundance estimates is 36,235.

Current Population Trend

There are insufficient data to determine the population trends for this species, given that surveys prior to 1998 did not differentiate between species of spotted dolphins.

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 annual estimated average fishery-related mortality or serious injury to this stock during 1999-2003 was zero Atlantic spotted dolphins (*Stenella* spp.) (Yeung 2001; Garrison 2003; Garrison and Richards, 2004).

Earlier Interactions

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

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 that were sent to the Smithsonian were identified as Pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), no fishery in 1997 and 0 in 1998.

The pelagic longline fishery operates in the U.S. Atlantic (including Caribbean) and Gulf of Mexico EEZ. Interactions between the pelagic longline fishery and spotted dolphins have been reported; however, a vessel may fish in more than one statistical reporting area and it is not possible to separate estimates of fishing effort other than to subtract Gulf of Mexico effort from Atlantic fishing effort, which includes the Caribbean Sea. From 1999-2003, excluding the Gulf of Mexico, where one animal was hooked and released alive (Appendix 1), no Atlantic spotted dolphin bycatches were recorded.

Other Mortality

From 1999-2003, 17 Atlantic spotted dolphins were stranded between Massachusetts and Florida (NMFS unpublished data). One animal stranded in North Carolina in 1999, 3 animals stranded in North Carolina and 1 stranded in Georgia in 2000, 2 animals stranded in North Carolina and 3 in Florida in 2001, 2 animals stranded in North Carolina and 2 in Florida in 2002, and 1 animal stranded in Massachusetts, 1 in North Carolina and 1 in Florida in 2003. None of these strandings had documented signs of 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.

STATE	1999	2000	2001	2002	2003	TOTALS
Massachusetts	0	0	0	0	1	1
North Carolina	0	3	2	2	1	8
South Carolina	1	0	0	0	0	1
Georgia	0	1	0	0	0	1
Florida	0	0	3	2	1	6
TOTALS	1	4	5	4	3	17

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 fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual fishery-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

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 200m 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

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin 1987; Perrin and Hohn 1994). Sightings of this species in the northern Gulf of Mexico occur over the deeper waters, and rarely over the continental shelf or continental shelf edge (Mullin *et al.* 1991; SEFSC, unpublished data). Pantropical spotted dolphins were seen in all seasons during recent seasonal aerial surveys of the northern Gulf of Mexico, and during recent winter aerial surveys offshore of the southeastern 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); however, there is no information on stock differentiation in the Atlantic population.

POPULATION SIZE

Total numbers of pantropical spotted dolphins 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 *S. frontalis* and *S. attenuata* are difficult to differentiate at sea, the reported abundance estimates, prior to 1998, are for both species of spotted dolphins combined. Sightings were concentrated in the southeastern edge of Georges Bank, along the Florida shelf and to a more limited degree the Florida slope waters, and offshore in Gulf Stream waters southeast of Cape Hatteras (Fig. 1).

An abundance of 6,107 undifferentiated spotted dolphins ($CV=0.27$) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

An abundance of 4,772 ($CV=1.27$) undifferentiated spotted dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; Palka *et al.* Unpubl. Ms.). Total trackline length was 32,600km. The ships covered waters between the 50 and 1000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the Mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of Maine, and shelf waters off Nova Scotia from the coastline to the 1000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

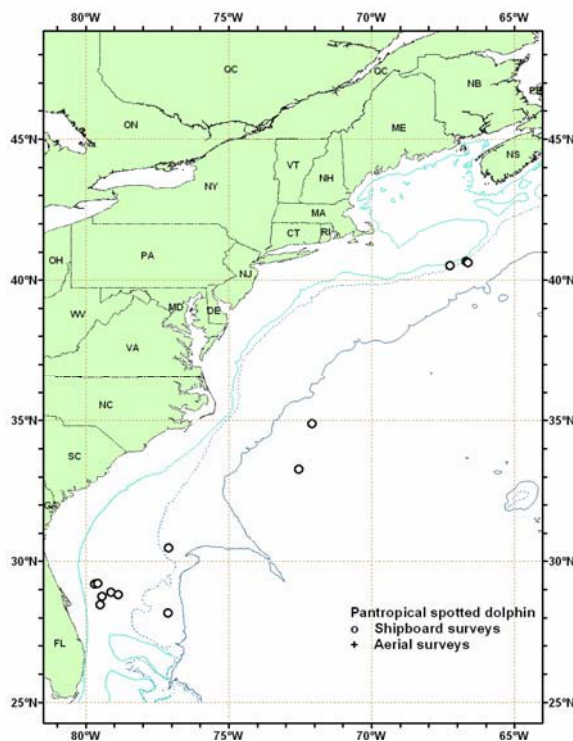


Figure 1. Distribution of pantropical spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m isobaths.

An abundance of 343 (CV=1.03) for pantropical spotted dolphins was estimated from a line transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900km of track line in waters north of Maryland (38° N) (Figure 1; Palka *et al.* Unpubl. Ms.). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 12, 747 (CV=0.56) for pantropical spotted dolphins was estimated from a shipboard line transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163km of track line in waters south of Maryland (38°N) (Figure 1; Mullin and Fulling 2003). This estimate is a recalculation of the same data reported in previous SARs. For more details see Mullin and Fulling (2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 2003) where school size bias and ship attraction were accounted for.

An abundance of zero for pantropical spotted dolphins was estimated 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) (Figure 1; Palka unpubl.), 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 (Figure 1; Palka unpubl.).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths = 50m) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x 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 pantropical spotted dolphins between Florida and Maryland was 4,439 (CV=0.49).

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' ranges. This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat. The best 2004 abundance estimate for pantropical spotted dolphins is the sum of the estimates from the two 2004 western U.S. Atlantic surveys, 4,439 (CV=0.49), where the estimate from the northern U.S. Atlantic is 0, and from the southern U.S. Atlantic is 4,439 (CV=0.49).

Table 1. Summary of abundance estimates for pantropical spotted 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
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	343 ^a	1.03
Jul-Aug 1998	Florida to Maryland	12,747 ^a	0.56
Jul-Aug 1998	Florida to Gulf of St. Lawrence (COMBINED)	13,090	0.55
Jun-Aug 2004	Maryland to 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

^a This represents the first estimates for pantropical spotted dolphin.

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 the population trends for this species, because prior to 1998 spotted dolphins (*Stenella* sp.) 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 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 annual estimated average fishery-related mortality or serious injury to this stock during 1999-2003 was zero pantropical spotted dolphins, as there were no reports of mortality or serious injury to pantropical spotted dolphins (Yeung 2001; Garrison 2003; Garrison and Richards, 2004).

Earlier Interactions

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

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 that were sent to the Smithsonian were identified as pantropical spotted dolphins (*S. attenuata*). The remaining animals were not identified to species. Estimated annual mortality and serious injury attributable to this fishery (CV in parentheses) was 25 in 1989 (.65), 51 in 1990 (.49), 11 in 1991 (.41), 20 in 1992 (0.18), 8.4 in 1993 (0.40), 29 in 1994 (0.01), 0 in 1995, 2 in 1996 (0.06), no fishery in 1997 and 0 in 1998.

The pelagic longline fishery operates in the U.S. Atlantic (including Caribbean) and Gulf of Mexico EEZ (SEFSC unpublished data). Interactions between the pelagic longline fishery and spotted dolphins have been reported; however, a vessel may fish in more than one statistical reporting area and it is not possible to separate estimates of fishing effort other than to subtract Gulf of Mexico effort from Atlantic fishing effort, which includes the Caribbean Sea. Excluding the Gulf of Mexico where 1 animal was hooked and released alive, no pantropical spotted dolphin bycatches were observed during 1999-2003.

Other Mortality

From 1999-2003, 6 pantropical spotted dolphins were stranded between North Carolina and Puerto Rico (NMFS unpublished data). The 6 mortalities includes the 4 animals stranded in Florida in 1999, 1 animal stranded in North Carolina and 1 in Florida in both 2002 and 2003. There were no documented signs of 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.

STATE	1999	2000	2001	2002	2003	TOTALS
North Carolina	0	0	0	0	0	0
South Carolina	0	0	0	0	0	0
Georgia	0	0	0	0	0	0
Florida	4	0	1	1	0	6
Puerto Rico	0	0	0	0	0	0
TOTALS	4	0	1	1	0	6

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 fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. Average annual fishery-related mortality and serious injury does not exceed the PBR; therefore, this is not a strategic stock

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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; Palka *et al.* Unpub. Ms.; 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 of the habitat do exist for select time periods. Sightings were almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 1). An abundance of 36,780 striped dolphins (CV=0.27) was estimated from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance of 25,939 (CV=0.36) and 13,157 (CV=0.45) striped dolphins was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (NMFS 1991). The study area included that covered in the CETAP study plus several additional continental slope survey blocks. Due to weather and logistical constraints, several survey blocks south and east of Georges Bank were not surveyed. As recommended in the GAMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

An abundance of 31,669 (CV=0.73) striped dolphins was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Palka *et al.* Unpub. Ms.). Total track line length was 32,600 km. The ships covered waters between the 50 and 1,000 fathom depth contour lines, the northern edge of the Gulf Stream, and the northern Gulf of Maine/Bay of Fundy region. The airplane covered waters in the Mid-Atlantic from the coastline to the 50 fathom depth contour line, the southern Gulf of

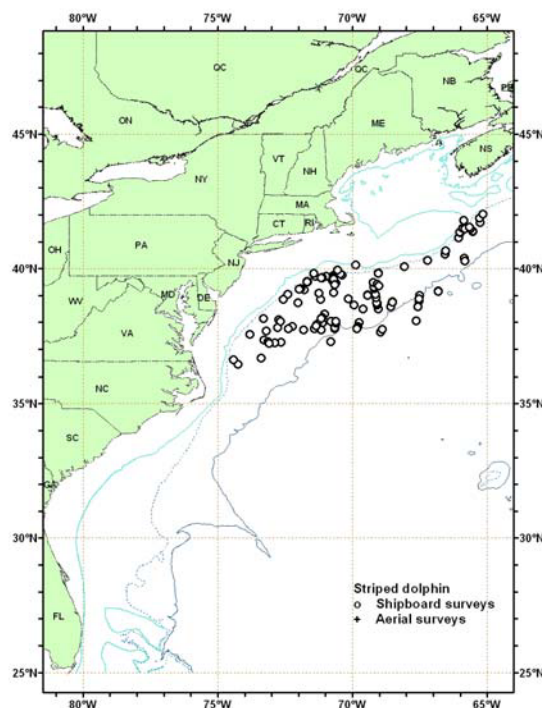


Figure 1. Distribution of striped dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer 1998, 1999, and 2004. Isotherms are at 100 m, 1,000 m, and 4,000 m.

Maine, and shelf waters off Nova Scotia from the coastline to the 1,000 fathom depth contour line. Data collection and analysis methods used were described in Palka (1996).

An abundance of 39,720 (CV=0.45) for striped dolphins 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) (Figure 1; Palka *et al.* unpublished Ms.). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 10,225 (CV=0.91) for striped dolphins 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) (Figure 1; Mullin and Fulling 2003). This estimate is a recalculation of the same data reported in previous SARs. For more details see Mullin and Fulling (2003). Abundance estimates were made using the program DISTANCE (Buckland *et al.* 1993) where school size bias and ship attraction were accounted for.

The best 1998 abundance estimate for striped dolphins is the sum of the estimates from the two U.S. Atlantic surveys, 49,945 (CV=0.40), where the estimate from the northern U.S. Atlantic is 39,720 (CV=0.45) and from the southern U.S. Atlantic is 10,225 (CV=0.91). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

An abundance of 52,055 (CV=0.57) for striped dolphins was estimated 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) (Figure 1; Palka unpublished). 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 (Figure 1; Palka unpublished).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50m) between Florida and Maryland (27.5 and 38°N) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 50x 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 striped dolphins between Florida and Maryland was 42,407 (CV =0.53).

The best 2004 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.

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
Jul-Sep 1998	Maryland to Gulf of St. Lawrence	39,720	0.45
Jul-Aug 1998	Florida to Maryland	10,225	0.91
Jul-Sep 1998	Florida to Gulf of St. Lawrence (COMBINED)	49,945	0.40
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). The minimum population estimate for the western North Atlantic striped dolphin is 68,558.

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. 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 1999-2003 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 Sea Samplers 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 1960s and early 1970s 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, forty-three 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 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.

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 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 fishery-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 dolphin is distributed worldwide in tropical waters (Perrin *et al.* 1994). Fraser's dolphins 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 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 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). Abundances have not been estimated from the 1999 vessel survey in western North Atlantic (NMFS 1999); 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.

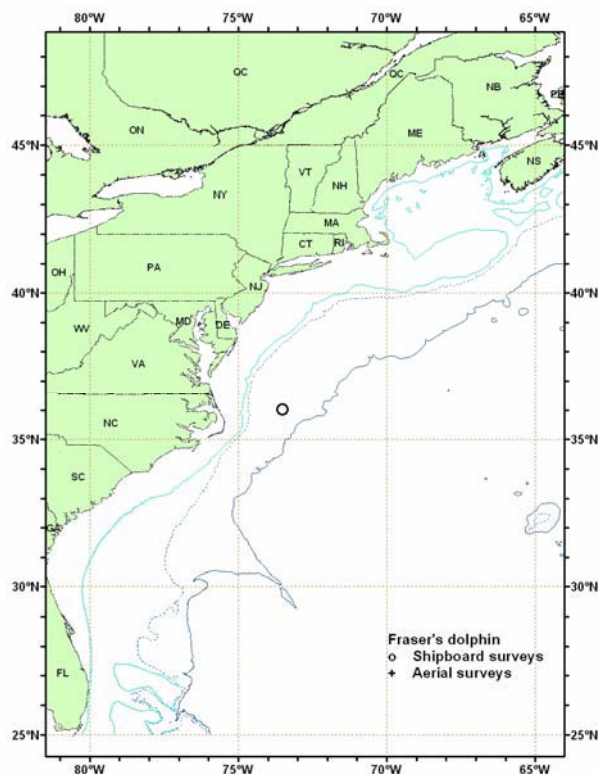


Figure 1. Distribution of Fraser's dolphins from SEFSC shipboard survey during 1999. All sightings are shown. Solid lines indicate the 100 m, 1,000 m, and 4,000 m isobaths.

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 1999-2003 was zero Fraser's dolphins, as there were no reports of mortality or serious injury to Fraser's dolphins (Yeung 2001; Garrison 2003; Garrison and Richards, 2004).

Other Mortality

From 1999-2003, 12 Fraser's dolphins were reported stranded between Maine and Puerto Rico (Table 1). The total includes 1 animal stranded in Puerto in 1999 and 1 in 2002, and 10 mass stranded live animals in April 2003 in Lee, Florida. 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.

STATE	1999	2000	2001	2002	2003	TOTAL
North Carolina	0	0	0	0	0	0
South Carolina	0	0	0	0	0	0
Georgia	0	0	0	0	0	0
Florida	0	0	0	0	10 ^a	10
Puerto Rico	1	0	0	1	0	2
TOTAL	1	0	0	1	10	12

^aFlorida 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 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.

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 distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for the western North Atlantic Clymene dolphin stock, based on the 1998 surveys, is 6,086 (CV=0.93). The minimum population estimate for the western North Atlantic stock is 3,132 Clymene dolphins.

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

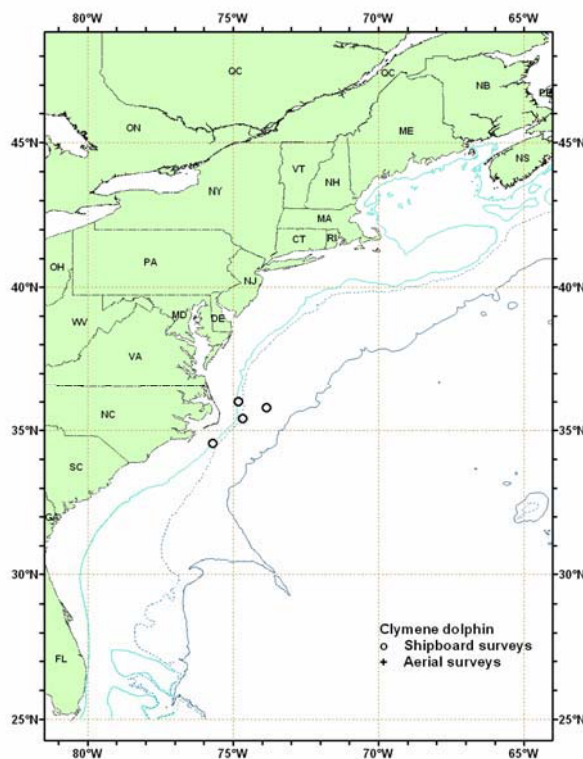


Figure 1. Distribution of Clymene dolphin sightings from NEFSC and SEFSC vessel and aerial summer surveys during 1998. Isobaths are at 100 m, 1,000 m, and 4,000 m.

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 (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 3,132. 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 Clymene dolphin stock is 31.

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 1999-2003 was zero Clymene dolphins, as there were no reports of mortalities or serious injury to Clymene dolphins (Yeung 2001; Garrison 2003; Garrison and Richards, 2004).

Other Mortality

There have been 2 reported strandings of Clymene dolphins in the western North Atlantic between 1999- 2003. No signs of human interactions were noted in either stranding. 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 the population trends for this stock. The total fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because the average annual fishery-related mortality and serious injury has not exceeded PBR for the last two years.

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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. Stock structure in the western North Atlantic is unknown.

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 1999-2003 was zero spinner dolphins, as there were no reports of mortalities or serious injury to spinner dolphins (Yeung 2001; Garrison 2003; Garrison and Richards, 2004).

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 by NMFS Sea Samplers in the now prohibited pelagic drift gillnet fishery, but no mortalities or serious injuries have been documented in the pelagic longline, pelagic pair trawl, Northeast sink gillnet, Mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries.

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 1999-2003, 9 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), and 1 additional animal stranded in Florida in 2003. 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.

STATE	1999	2000	2001	2002	2003	TOTALS
North Carolina	0	0	2	0	0	2
South Carolina	0	0	0	0	0	0
Georgia	0	0	0	0	0	0
Florida	0	0	0	0	5 ^a	5
Puerto Rico	0	0	0	2	0	2
TOTALS	0	0	2	2	5	9

^aIncludes live mass stranding of 4 animals in Flagler, Florida on December 29, 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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BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Western North Atlantic Offshore Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two morphologically and genetically distinct bottlenose dolphin morphotypes (Duffield et al. 1983; Duffield 1986) described as the coastal and offshore forms. Both inhabit waters in the western North Atlantic Ocean (Hersh and Duffield 1990; Mead and Potter 1995; Curry and Smith 1997) along the U.S. Atlantic coast. The offshore and nearshore ecotypes are genetically distinct using both mitochondrial and nuclear markers (Hoelzel et al. 1998). Hersh and Duffield (1990) also described morphological differences between offshore morphotype dolphins and dolphins with hematological profiles matching the coastal morphotype which had stranded in the Indian/Banana River in Florida.

The offshore form is distributed primarily along the outer continental shelf and continental slope in the Northwest Atlantic Ocean. North of Cape Hatteras, there is clear separation of the two morphotypes across bathymetry during summer months. Aerial surveys flown during 1979-1981 indicated a concentration of bottlenose dolphins in waters < 25 m deep corresponding to the coastal morphotype, and an area of high abundance along the shelf break corresponding to the offshore type (CETAP 1982; Kenney 1990). Biopsy tissue sampling and genetic analysis demonstrated that bottlenose dolphins concentrated close to shore were of the coastal morphotype, while those in waters > 40 m deep were from the offshore morphotype (Garrison et al. 2003). However, during winter months and south of Cape Hatteras, NC the range of the coastal and offshore morphotypes overlap to some degree. Torres et al. (2003) found a statistically significant break in the distribution of the ecotypes at 34 km from shore based upon the genetic analysis of tissue samples collected in nearshore and offshore waters. The offshore morphotype was found exclusively seaward of 34 km and in waters deeper than 34 m. Within 7.5 km of shore, all animals were of the coastal morphotype. Systematic biopsy collection surveys were conducted coastwide during the summer and winter between 2001-2003 to evaluate the degree of spatial overlap between the two morphotypes. Over the continental shelf south of Cape Hatteras, NC the two morphotypes overlap spatially, and the probability of a sampled group being from the offshore morphotype increased with increasing depth based upon a logistic regression analysis. Offshore morphotype animals have been sampled as close as 7.3 km from shore in water depths of 13 m (Garrison et al. 2003).

Seasonally, bottlenose dolphins occur over the outer continental shelf and inner slope waters as far north as Georges Bank (Figure 1; CETAP 1982; Kenney 1990). Sightings occurred along the continental shelf break from Georges Bank to Cape Hatteras during spring and summer (CETAP 1982; Kenney 1990). In Canadian waters, bottlenose dolphins have occasionally been sighted on the Scotian Shelf, particularly in the Gully (Gowans and Whitehead 1995; NMFS unpublished data). Recent information from Wells et al. (1999) indicates that the range of the offshore bottlenose dolphin may include waters beyond the continental slope and that offshore bottlenose dolphins may move between the Gulf of Mexico and the Atlantic. Offshore morphotype bottlenose dolphins have stranded as far south as the Florida Keys.

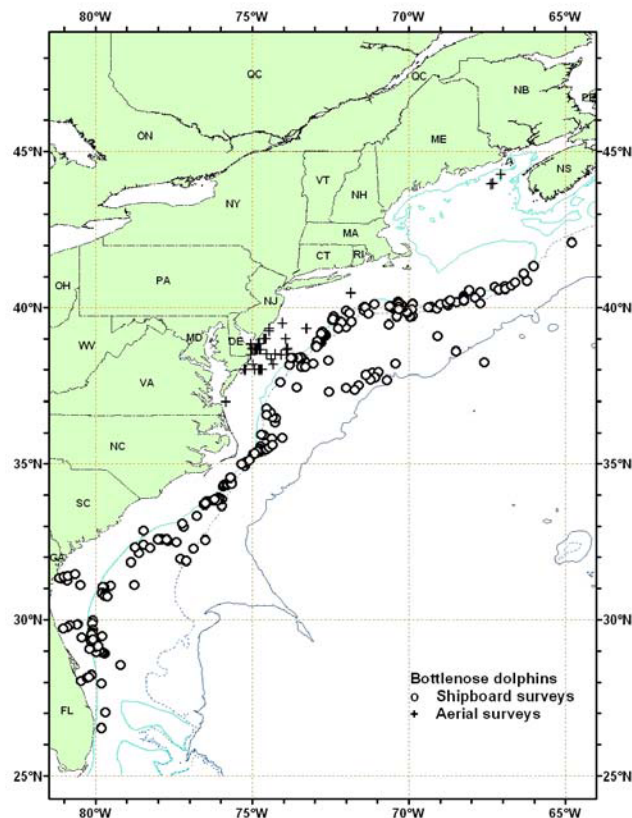


Figure 1. Distribution of bottlenose dolphin sightings from NEFSC and SEFSC aerial surveys during summer in 1998, 1999, and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.

POPULATION SIZE

An abundance of 16,689 (CV=0.32) bottlenose dolphins was estimated from a line-transect sighting survey conducted during July 6 to September 6, 1998, by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N) (Figure 1; Palka et al., unpublished manuscript). Shipboard data were analyzed using the modified direct duplicate method (Palka 1995) that accounts for school size bias and $g(0)$, the probability of detecting a group on the track line. Aerial data were not corrected for $g(0)$.

An abundance of 13,085 (CV=0.40) for bottlenose dolphins was estimated from a shipboard line transect sighting line-transect survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Fig. 1; Mullin and Fulling 2003). Abundance estimates were made using the program DISTANCE (Buckland et al. 2001; Thomas et al. 1998) accounting for school size bias.

During the summer (June - July) of 2002, aerial surveys were conducted along the U.S. Atlantic coast between Florida and New Jersey. A total of 6,734 km of trackline were completed during the summer survey between Sandy Hook, NJ to Ft. Pierce, FL. The abundance of bottlenose dolphins in survey strata were calculated using line transect methods and distance analysis, and the direct duplicate estimator was used to account for visibility bias (Buckland et al. 2001; Palka 1995). These estimates were further partitioned between the coastal and offshore morphotypes based upon the results of the logistic regression models and spatial analyses described above. A parametric bootstrap approach was used to incorporate the uncertainty in the logistic regression models into the overall uncertainty in the abundance estimate for offshore bottlenose dolphins (Garrison et al. 2003). The resulting coastwide abundance estimate for the offshore morphotype in waters < 40 m depth was 26,849 (CV = 0.193).

An abundance of 9,786 (CV = 0.56) for offshore morphotype bottlenose dolphins was estimated 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 38° N (Figure 1; Palka unpubl.). 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 (Figure 1; Palka unpubl.).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between 27.5 – 38 °N latitude was conducted during June-August, 2004. The survey employed two independent visual teams searching with 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 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 offshore morphotype bottlenose dolphins between Florida and Maryland was 44,953 (CV = 0.26).

The best available estimate for offshore morphotype bottlenose dolphins is the sum of the estimates from the summer 2002 aerial survey covering the continental shelf, the summer 2004 vessel survey south of Maryland, and the summer 2004 vessel and aircraft surveys north of Maryland. This joint estimate provides complete coverage of the offshore morphotype habitat from Florida to Georges Bank during summer months. The combined abundance estimate from these surveys is 81,588 (CV = 0.17).

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 minimum population estimate for western North Atlantic offshore bottlenose dolphin is 70,775.

Current Population Trend

The data are insufficient to determine population trends. Previous estimates cannot be applied to this process because previous survey coverage of the species' habitat was incomplete.

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 offshore bottlenose dolphins is 70,775. 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. However, because the CV for the fishery mortality estimate exceeds 0.8, the recovery factor was reduced to 0.4. PBR for the western North Atlantic offshore bottlenose dolphin is therefore 566.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total estimated mean annual fishery-related mortality for this stock during 1999-2003 was 26 (CV=1.16) bottlenose dolphins.

Fisheries Information

Bycatch has been observed in the pelagic drift gillnet, pelagic pair trawl, New England multispecies sink gillnet, North Atlantic bottom trawl and pelagic longline fisheries.

Pelagic Longline

The pelagic longline fishery operates in the U.S. Atlantic (including Caribbean) and Gulf of Mexico EEZ. Interactions between the pelagic longline fishery and bottlenose dolphins have been observed. These interactions occurred well offshore in deep waters, corresponding to the offshore morphotype. During 1993-1998, in Atlantic waters not including the Gulf of Mexico, 1 bottlenose dolphin was caught and released alive during 1993, and 1 was caught and released alive during 1998. In addition, one bottlenose dolphin was captured and released alive in 2003 (Garrison, 2003; Garrison and Richards, 2004.). There have been no observed mortalities or serious injuries of bottlenose dolphins in the pelagic longline fishery.

Pelagic Drift Gillnet

Estimated bottlenose dolphin mortalities (CV in parentheses) extrapolated for each year were 72 in 1989 (0.18), 115 in 1990 (0.18), 26 in 1991 (0.15), 28 in 1992 (0.10), 22 in 1993 (0.13), 14 in 1994 (0.04), 5 in 1995 (0), 0 in 1996, and 3 in 1998 (0). Since this fishery no longer exists, it has been excluded from Table 1.

Pelagic Pair Trawl

Thirty-two bottlenose dolphin mortalities were observed between 1991 and 1995. Estimated annual fishery-related mortality (CV in parentheses) was 13 dolphins in 1991 (0.52), 73 in 1992 (0.49), 85 in 1993 (0.41), 4 in 1994 (0.40) and 17 in 1995 (0.26). Since this fishery no longer exists, it has been excluded from Table 1.

North Atlantic Bottom Trawl

One bottlenose dolphin mortality was documented in 1991 and the total estimated mortality in this fishery in 1991 was 91 (CV=0.97). Since 1992 there were no bottlenose dolphin mortalities observed in this fishery.

Squid, Mackerel and Butterfish

Although there were reports of bottlenose dolphin mortalities in the foreign fishery during 1977-1988, there were no fishery-related mortalities of bottlenose dolphins reported in the self-reported fisheries information from the mackerel trawl fishery during 1990-1992.

New England Multispecies Sink Gillnet

The first observed mortality of bottlenose dolphins was recorded in 2000. This was genetically identified as an offshore, deep-water ecotype. The estimated annual fishery-related serious injury and mortality attributable to this fishery (CV in parentheses) was 0 from 1996-1999, and 132 (CV=1.16) in 2000. There have been no observed bottlenose dolphin mortalities since 2000 in this fishery (Table 1).

Mid-Atlantic Coastal Gillnet

Bottlenose dolphins were only reported during the trips in 1998, when 1 mortality was observed as a result of this fishery. Though this dolphin was not genetically identified, it is being treated as an offshore, deep-water ecotype because it was caught in the offshore habitat and statistical analyses of all biopsied bottlenose dolphins caught in this offshore habitat indicate this animal has a high probability of being the offshore ecotype. Observed effort was concentrated off New Jersey and scattered between Delaware and North Carolina from 1 to 50 miles off the beach. All bycatches were documented during January to April. Using the observed takes, the estimated annual mortality attributed to this fishery

was 0 in 1995 through 1997, 4 (CV=0.7) in 1998, and 0 from 1999 through 2000. A bottlenose dolphin was captured in the region of overlap over the continental shelf in the Mid-Atlantic gillnet fishery during May, 2001. Mortality estimates have not been developed for the offshore morphotype during 1999- 2003 due to the uncertainties associated with the relative distribution of the two morphotypes.

Table 1. Summary of the incidental mortality of offshore morphotype bottlenose dolphins (*Tursiops truncatus*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the mortalities recorded by on-board observers (Observed Mortality), the estimated annual mortality (Estimated Mortality), the estimated CV of the annual mortality (Estimated CVs) and the mean annual mortality (CV in parentheses).

Fishery	Years	Vessels	Data Type ^a	Observer Coverage ^b	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
New England Multisp.Sink Gillnet	99-03		Obs. Data Dealer Reports, Logbook	.06, .06, .04, .02, .03	0, 1, 0, 0, 0	0, 132, 0, 0, 0	0, 1.16, 0, 0, 0	26 (1.16)
Mid-Atlantic Coastal Gillnet	99-03	Unk ^c	Obs. Data Dealer Reports	.02, .02, .02, .01, .01	0, 0, 1, 0, 0	0, 0, NA, 0, 0	0, 0,NA, 0, 0	NA
Total								26 (1.16)

Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook (logbook) data collected by the Southeast Fisheries Science Center (SEFSC) are used to measure total effort for the pelagic drift gillnet fishery. The NEFSC collects landings data (Dealer Reports), and total landings are used as a measure of total effort for the gillnet fisheries. Mandatory vessel trip reports (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast multispecies sink gillnet fishery.

Observer coverage of the Northeast multispecies sink gillnet fishery is measured as the percentage of trips observed.

Observer coverage of the Mid-Atlantic coastal gillnet fishery is measured as the percentage of tons of fish landed.

Number of vessels is not known.

Other Mortality

Bottlenose dolphins are one of the most frequently stranded small cetaceans along the Atlantic coast. Many of the animals show signs of human interaction (i.e., net marks, mutilation, etc.). The estimated number of animals that represent the offshore morphotype is under evaluation.

STATUS OF STOCK

The status of this stock relative to OSP in the U.S. Atlantic EEZ is unknown. The western North Atlantic offshore bottlenose dolphin is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine the population trends for this species. Average 1999-2003 annual fishery-related mortality and serious injury does not exceed the PBR therefore this is not a strategic stock. The total fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

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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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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. 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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NORTHERN BOTTLENOSE WHALE (*Hyperoodon ampullatus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Northern bottlenose whales are characterized as extremely uncommon or rare in waters of the U.S. Atlantic Exclusive Economic Zone. The two sightings of three individuals constituted less than 0.1% of the 11,156 cetacean sightings in the 1978-82 CETAP surveys. Both sightings were in the spring, along the 2,000 m isobath (CETAP 1982). In 1993 and 1996, two sightings of single animals, and in 1996, a single sighting of six animals (one juvenile), were made during summer shipboard surveys conducted along the southern edge of Georges Bank (NMFS 1993; NMFS 1996).

Northern bottlenose whales are distributed in the North Atlantic from Nova Scotia to about 70° in the Davis Strait, along the east coast of Greenland to 77° and from England to the west coast of Spitzbergen. It is largely a deep-water species and is very seldom found in waters less than 2,000 m deep (Mead 1989).

There are two main centers of bottlenose whale distribution in the western north Atlantic, one in the area called "The Gully" just north of Sable Island, Nova Scotia, and the other in Davis Strait off northern Labrador (Reeves *et al.* 1993). Studies at the entrance to the Gully from 1988-1995 identified 237 individuals and estimated the local population size at about 230 animals (95% C.I. 160-360) (Whitehead *et al.* 1997). These individuals are believed to be year-round residents and all age and sex classes are present (Gowans and Whitehead 1998). Mitchell and Kozicki (1975) documented stranding records in the Bay of Fundy and as far south as Rhode Island. Stock definition is unknown.

POPULATION SIZE

The total number of northern bottlenose 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 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 northern bottlenose whale is unknown because the minimum population size cannot be determined.

ANNUAL HUMAN-CAUSED MORTALITY

No mortalities have been reported in U.S. waters. A fishery for northern bottlenose whales existed in Canadian waters during both the 1800s and 1900s. Its development was due to the discovery that bottlenose whales contained spermaceti. A Norwegian fishery expanded from east to west (Labrador and Newfoundland) in several episodes. The fishery peaked in 1965. Decreasing catches led to the cessation of the fishery in the 1970s, and provided evidence that the population was depleted. A small fishery operated by Canadian whalers from Nova Scotia operated in the Gully, and took 87 animals from 1962 to 1967 (Mead 1989; Mitchell 1977).

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 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 northern bottlenose whales relative to OSP in U.S. Atlantic EEZ is unknown; however, a depletion in Canadian waters in the 1970s may have impacted U.S. distribution and may be relevant to current status in U.S. waters. 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. Because there are no observed mortalities or serious injury, the total fishery-related mortality and serious injury for this stock is considered to be approaching zero mortality and serious injury rate. This is not a strategic stock because there are no recent records of fishery-related mortality or serious injury.

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SPERM WHALE (*Physeter macrocephalus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Sperm whales are found throughout the world's oceans in deep waters to the edge of the ice at both poles (Leatherwood and Reeves 1983; Rice 1989; Whitehead 2002). Seasonal aerial surveys confirm that sperm whales are present in the northern Gulf of Mexico in all seasons (Mullin *et al.* 1994; Hansen *et al.* 1996; Mullin and Hoggard 2000).

There has been speculation, based on year-round occurrence of strandings, opportunistic sightings and whaling catches, that sperm whales in the Gulf of Mexico may constitute a distinct stock (Schmidly 1981). The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

Disturbance by anthropogenic noise may prove to be an important habitat issue in some areas of this population's range, notably in areas of oil and gas activities and/or where shipping activity is high. Limited studies are currently being conducted to address this issue and its impact, if any, on this and other marine species. The potential impact, if any, of coastal pollution may be an issue for this species in portions of its habitat, though little is known on this to date.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of sperm whales for all surveys combined was 530 (CV=0.31) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations. Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate. The estimate of abundance for sperm whales in oceanic waters, pooled from 1996 to 2001, is 1,349 (CV=0.23) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

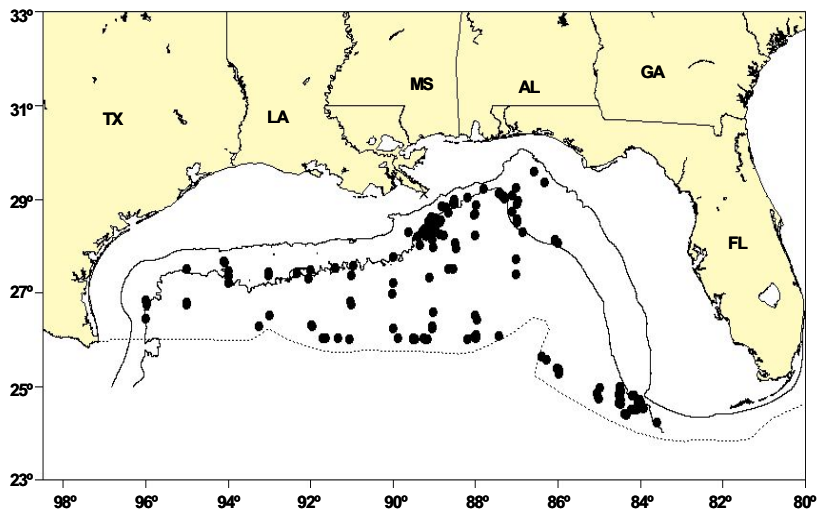


Figure 1. Distribution of sperm whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate

as specified by Wade and Angliss (1997). The best estimate of abundance for sperm whales is 1,349 (CV=0.23). The minimum population estimate for the northern Gulf of Mexico is 1,114 sperm whales.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 1,349 (CV=0.29) and that for 1991-1994 of 530 (CV=0.31) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is relatively low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 1,114 (CV=0.23). 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 0.1 because the sperm whale is an endangered species. PBR for the northern Gulf of Mexico sperm whale is 2.2.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a sperm whale during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

A commercial fishery for sperm whales operated in the Gulf of Mexico in deep waters between the Mississippi River delta and DeSoto Canyon during the late 1700s to the early 1900s (Mullin *et al.* 1991), but the exact number of whales taken is not known (Townsend 1935; Lowery 1974). Townsend (1935) reported many records of sperm whales from April through July in the north-central Gulf (Petersen and Hoggard 1996).

Fisheries Information

The level of past or current, direct, human-caused mortality of sperm whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to sperm whales by this fishery.

Other Mortality

A total of 9 sperm whale strandings were documented in the northern Gulf of Mexico during 1999-2003 (Table 1). There was no evidence of human interactions for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	0	0
Florida	1	2	1	1	1	6
Louisiana	1	0	0	0	1	2
Mississippi	0	0	0	0	0	0
Texas	0	1	0	0	0	1
Total	2	3	1	1	2	9

STATUS OF STOCK

The status of sperm whales in the northern Gulf of Mexico, relative to OSP, is unknown. This species is listed as endangered under the Endangered Species Act (ESA). There are insufficient data to determine the population trends for this species. The total fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because the sperm whale is listed as an endangered species under the ESA.

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BRYDE'S WHALE (*Balaenoptera edeni*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bryde's whales are distributed worldwide in tropical and sub-tropical waters. In the western Atlantic Ocean, Bryde's whales are reported from off the southeastern United States and the southern West Indies to Cabo Frio, Brazil (Leatherwood and Reeves 1983). Most of the sighting records of Bryde's whales in the Gulf of Mexico are from NMFS abundance surveys that were conducted during the spring (Figure 1; Hansen *et al.* 1995; Hansen *et al.* 1996; Mullin and Hoggard 2000; Mullin and Fulling 2004). However, there are stranding records from throughout the year (Würsig *et al.* 2000).

It has been postulated that the Bryde's whales found in the Gulf of Mexico may represent a resident stock (Schmidly 1981; Leatherwood and Reeves 1983), but there is no information on stock differentiation. The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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.

From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of Bryde's whales for all surveys combined from 1991 through 1994 was 35 (CV=1.10) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for Bryde's whales in oceanic waters, pooled from 1996 to 2001, is 40 (CV=0.61) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Bryde's whales is 40 (CV=0.61). The minimum population estimate for the northern Gulf of Mexico is 25 Bryde's whales.

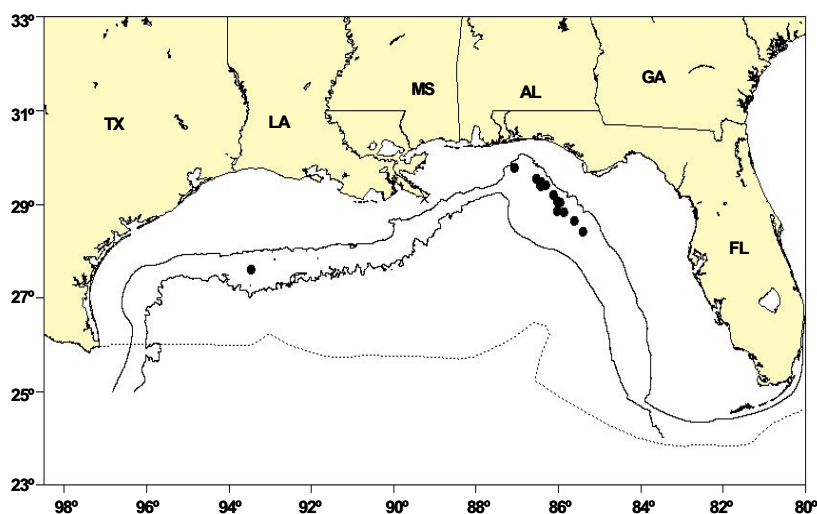


Figure 1. Distribution of Bryde's whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 40 (CV=0.61) and that for 1991-1994 of 35 (CV=1.09) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 25. 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 the stock is of unknown status. PBR for the northern Gulf of Mexico Bryde’s whale is 0.3.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of Bryde’s whales during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of Bryde’s whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to Bryde’s whales by this fishery.

Other Mortality

There were no reported strandings of Bryde’s whales in the Gulf of Mexico during 1999-2003. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of Bryde’s whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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CUVIER'S BEAKED WHALE (*Ziphius cavirostris*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Cuvier's beaked whales are distributed throughout the world's oceans except for the polar regions (Leatherwood and Reeves 1983; Heyning 1989). Strandings have occurred in all months along the east coast of the U.S. (Schmidly 1981) and throughout the year in the Gulf of Mexico (Würsig *et al.* 2000). Beaked whales were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico (Hansen *et al.* 1996; Mullin and Hoggard 2000). Some of the aerial survey sightings may have included Cuvier's beaked whale, but identification of beaked whale species from aerial surveys is problematic.

Strandings of Cuvier's beaked whales along the west coast of North America, based on skull characteristics, are thought to represent members of a panmictic population (Mitchell 1968), but there is no information on stock differentiation in the Gulf of Mexico and nearby waters. In the absence of adequate information on stock structure, a species' range within an ocean should be divided into defensible management units, and such management units include distinct oceanographic regions (Wade and Angliss 1997). The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of Cuvier's beaked whales for all surveys combined was 30 (CV=0.50). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for Cuvier's beaked whales in oceanic waters, pooled from 1996 to 2001, is 95 (CV=0.47) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico. The estimated abundance of Cuvier's beaked whales is negatively biased because only sightings of beaked whales which could be positively identified to species were used. The estimate for the same time period for unidentified Ziphiidae is 146 (CV=0.46) which may include an unknown number of *Mesoplodon* spp.

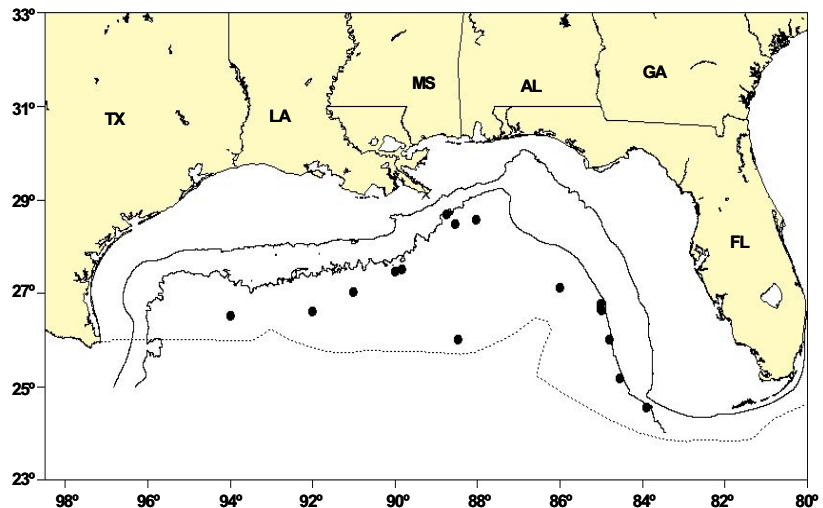


Figure 1. Distribution of Cuvier's beaked whale sightings from SEFSC shipboard spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Cuvier's beaked whales is 95 (CV=0.47). The minimum population estimate for the northern Gulf of Mexico is 65 Cuvier's beaked whales.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 95 (CV=0.47) and that for 1991-1994 of 30 (CV=0.50) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Cuvier's beaked whale is 65 (CV=0.47). The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor for this stock is 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico Cuvier's beaked whale is 0.7.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a Cuvier's beaked whale during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of Cuvier's beaked whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to Cuvier's beaked whales by this fishery.

Other Mortality

Cuvier's beaked whales were taken occasionally in a small, directed fishery for cetaceans that operated out of the Lesser Antilles (Caldwell and Caldwell 1971). There were no reported strandings of Cuvier's beaked whales in the Gulf of Mexico during 1999-2003. Two unidentified beaked whales mass stranded in Florida in December 1999. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with military naval activities. During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whales and Blainville's beaked whales occurred in the Canary Islands (Simmonds and Lopez-Jurado (1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Evans and England 2001; Balcomb and Claridge 2001; Cox *et al.*, in review). Four Cuvier's, 2 Blainville's, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown. Necropsies of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Evans and England 2001; Cox *et al.*, in review).

STATUS OF STOCK

The status of Cuvier's beaked whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because of evidence of human induced mortality and serious injury associated with acoustic activities.

Disturbance by anthropogenic noise may prove to be an important habitat issue in some areas of this population's range, notably in areas of oil and gas activities or where shipping or naval activities are high. Limited studies are currently being conducted to address this issue and its impact, if any, on this and other marine species.

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BLAINVILLE'S BEAKED WHALE (*Mesoplodon densirostris*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Three species of *Mesoplodon* are known to occur in the Gulf of Mexico, based on stranding or sighting data (Hansen *et al.* 1995; Würsig *et al.* 2000). These are Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*) and Sowerby's beaked whale (*M. bidens*). Sowerby's beaked whale in the Gulf of Mexico is considered extralimital because there is only 1 known stranding of this species (Bonde and O'Shea 1989) and because it normally occurs in northern temperate waters of the North Atlantic (Mead 1989). Identification of *Mesoplodon* to species in the Gulf of Mexico is very difficult, and in many cases, *Mesoplodon* and Cuvier's beaked whale (*Ziphius cavirostris*) cannot be distinguished; therefore, sightings of beaked whales (Family Ziphiidae) are identified as *Mesoplodon* sp., Cuvier's beaked whale, or unidentified Ziphiidae.

Blainville's beaked whales appear to be widely but sparsely distributed in temperate and tropical waters of the world's oceans (Leatherwood *et al.* 1976; Leatherwood and Reeves 1983). Strandings have occurred along the northwestern Atlantic coast from Florida to Nova Scotia (Schmidly 1981), and there have been 4 documented strandings and 2 sightings of this species in the northern Gulf of Mexico (Hansen *et al.* 1995; Würsig *et al.* 2000). Beaked whales were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico from 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of undifferentiated beaked whales (*Mesoplodon* spp. and unidentified Ziphiidae) for all surveys combined was 117 (CV=0.38) (Hansen *et al.* 1995). Hansen *et al.* (1995) did not estimate the abundance of *Mesoplodon* spp. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

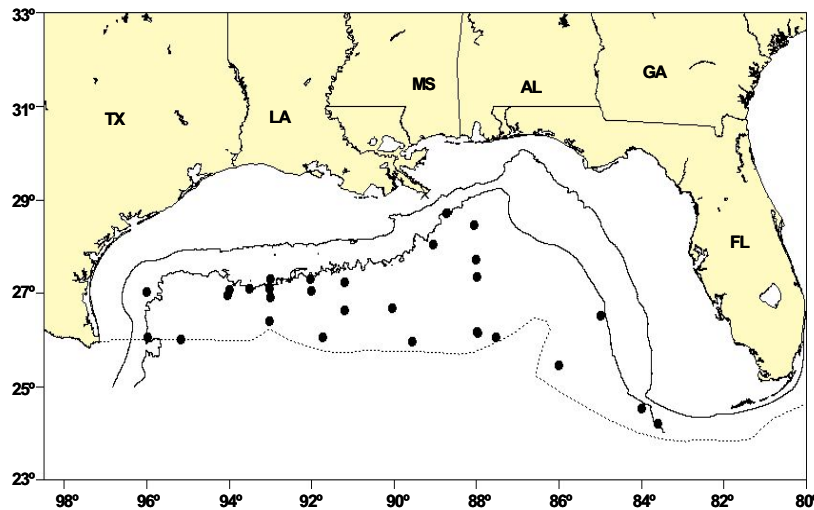


Figure 1. Distribution of beaked whale sightings (*Mesoplodon* spp.) from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

The estimate of abundance for *Mesoplodon* spp. in oceanic waters, pooled from 1996 to 2001, is 106 (CV=0.41) (Mullin and Fulling 2004), which is the best available abundance estimate for these species in the northern Gulf of Mexico. This is a combined estimate for Gervais' beaked whale and Blainville's beaked whale. The estimate for the same time period for unidentified Ziphiidae is 146 (CV=0.46) which may also include an unknown number of Cuvier's beaked whales.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp. is 106 (CV=0.41). The minimum population estimate for *Mesoplodon* spp. in the northern Gulf of Mexico is 76.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for *Mesoplodon* spp. is 76. 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 the stock is of unknown status. PBR for the northern Gulf of Mexico *Mesoplodon* spp. is 0.8. It is not possible to determine the PBR for only Blainville's beaked whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a beaked whale during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of beaked whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to Blainville's or other beaked whales by this fishery.

Other Mortality

There were 2 reported stranding events of beaked whales in the Gulf of Mexico during 1999-2003. Two unidentified beaked whales mass stranded in Florida in December 1999, and 1 unidentified *Mesoplodon* stranded in Florida in January 2003. There was no evidence of human interactions for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with military naval activities. During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whales and Blainville's beaked whales occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998). In March 2000, 14 beaked whales live stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (NMFS 2001; Balcomb and Claridge 2001; Cox *et al.*, in review). Four Cuvier's, 2 Blainville's and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown. Necropsies of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (NMFS 2001; Cox *et al.*, in review).

STATUS OF STOCK

The status of Blainville's beaked whales or other beaked whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because of uncertainty regarding stock size and evidence of human induced mortality and serious injury associated with acoustic activities.

Disturbance by anthropogenic noise may prove to be an important habitat issue in some areas of this population's range, notably in areas of oil and gas activities or where shipping or naval activities are high. Limited studies are currently being conducted to address this issue and its impact, if any, on this and other marine species.

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GERVAIS' BEAKED WHALE (*Mesoplodon europaeus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Three species of *Mesoplodon* are known to occur in the Gulf of Mexico, based on stranding or sighting data (Hansen *et al.* 1995; Würsig *et al.* 2000). These are Blainville's beaked whale (*M. densirostris*), Gervais' beaked whale (*M. europaeus*), and Sowerby's beaked whale (*M. bidens*). Sowerby's beaked whale in the Gulf of Mexico is considered extralimital because there is only 1 known stranding of this species (Bonde and O'Shea 1989) and because it normally occurs in northern temperate waters of the North Atlantic (Mead 1989). Identification of *Mesoplodon* to species in the Gulf of Mexico is very difficult, and in many cases, *Mesoplodon* and Cuvier's beaked whale (*Ziphius cavirostris*) cannot be distinguished; therefore, sightings of beaked whales (Family Ziphiidae) are identified as *Mesoplodon* sp., Cuvier's beaked whale, or unidentified Ziphiidae.

Gervais' beaked whales appear to be widely but sparsely distributed in temperate and tropical waters of the world's oceans (Leatherwood *et al.* 1976; Leatherwood and Reeves 1983). Strandings have occurred along the northwestern Atlantic coast from Florida to Nova Scotia (Schmidly 1981), and there have been 16 documented strandings in the Gulf of Mexico (Würsig *et al.* 2000). Beaked whales were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico from 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

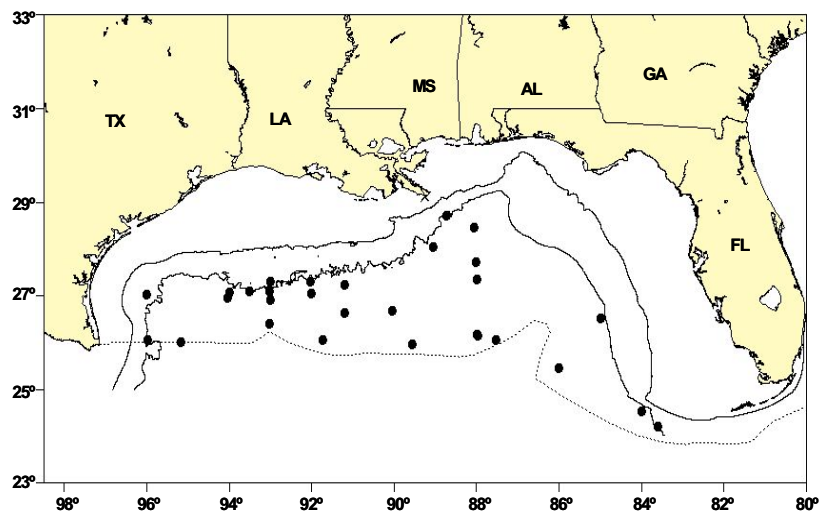


Figure 1. Distribution of beaked whale sightings (*Mesoplodon* spp.) from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of undifferentiated beaked whales (*Ziphius* and *Mesoplodon* spp.) for all surveys combined was 117 (CV=0.38) (Hansen *et al.* 1995). Hansen *et al.* (1995) did not estimate the abundance of *Mesoplodon* spp. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total

estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for *Mesoplodon* spp. in oceanic waters, pooled from 1996 to 2001, is 106 (CV=0.41) (Mullin and Fulling 2004), which is the best available abundance estimate for these species in the northern Gulf of Mexico. This is a combined estimate for Blainville's beaked whale and Gervais' beaked whale. The estimate for the same time period for unidentified Ziphiidae is 146 (CV=0.46) which may also include an unknown number of Cuvier's beaked whales.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for *Mesoplodon* spp. is 106 (CV = 0.41). The minimum population estimate for *Mesoplodon* spp. in the northern Gulf of Mexico is 76.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for *Mesoplodon* spp. is 76. 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 the stock is of unknown status. PBR for the northern Gulf of Mexico *Mesoplodon* spp. is 0.8. It is not possible to determine the PBR for only Gervais' beaked whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a beaked whale during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of beaked whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to Gervais' or other beaked whales by this fishery.

Other Mortality

There were 2 reported stranding events of beaked whales in the Gulf of Mexico during 1999-2003. Two unidentified beaked whales mass stranded in Florida in December 1999, and 1 unidentified *Mesoplodon* stranded in Florida in January 2003. There was no evidence of human interactions for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with military naval activities. During the mid- to late 1980s multiple mass strandings of Cuvier's beaked whales (4 to about 20 per event) and small numbers of Gervais' beaked whales and Blainville's beaked whales occurred in the Canary Islands (Simmonds and Lopez-Jurado 1991). Twelve Cuvier's beaked whales that live stranded and subsequently died in the Mediterranean Sea on 12-13 May 1996 were associated with low frequency acoustic sonar tests conducted by the North Atlantic Treaty Organization (Frantzis 1998). In March 2000, 14 beaked whales live

stranded in the Bahamas; 6 beaked whales (5 Cuvier's and 1 Blainville's) died (Evans and England 2001; Balcomb and Claridge 2001; Cox *et al.*, in review). Four Cuvier's, 2 Blainville's, and 2 unidentified beaked whales were returned to sea. The fate of the animals returned to sea is unknown. Necropsies of 6 dead beaked whales revealed evidence of tissue trauma associated with an acoustic or impulse injury that caused the animals to strand. Subsequently, the animals died due to extreme physiologic stress associated with the physical stranding (i.e., hyperthermia, high endogenous catecholamine release) (Evans and England 2001; Cox *et al.*, in review).

STATUS OF STOCK

The status of Gervais' beaked whales or other beaked whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is a strategic stock because of uncertainty regarding stock size and evidence of human induced mortality and serious injury associated with acoustic activities.

Disturbance by anthropogenic noise may prove to be an important habitat issue in some areas of this population's range, notably in areas of oil and gas activities or where shipping or naval activities are high. Limited studies are currently being conducted to address this issue and its impact, if any, on this and other marine species.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Northern Gulf of Mexico Continental Shelf Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Gulf of Mexico continental shelf bottlenose dolphin stock inhabits waters from 20 to 200m deep in the northern Gulf from the U.S.-Mexican border to the Florida Keys (Figure 1). Both “coastal” and “offshore” ecotypes of bottlenose dolphins (Hersh and Duffield 1990) occur in the Gulf of Mexico (LeDuc and Curry 1998). The continental shelf stock probably consists of a mixture of both the coastal and offshore ecotypes. The offshore and nearshore ecotypes are genetically distinct using both mitochondrial and nuclear markers (Hoelzel *et al.* 1998). In the northwestern Atlantic, Torres *et al.* (2003) found a statistically significant break in the distribution of the ecotypes at 34km from shore. The offshore ecotype was found exclusively seaward of 34km and in waters deeper than 34m. Within 7.5km of shore, all animals were of the coastal ecotype. The continental shelf is much wider in the Gulf of Mexico so these results may not apply. The continental shelf stock range may extend into Mexican and Cuban territorial waters; however, there are no available estimates of either abundance or mortality from those countries.

The bottlenose dolphins inhabiting waters <20m deep in the U.S. Gulf are believed to constitute 36 inshore or coastal stocks. An oceanic stock is provisionally defined for bottlenose dolphins inhabiting waters >200m. Both inshore and coastal stocks and the oceanic stock are separate from the continental shelf stock. However, the continental shelf stock may overlap with coastal stocks and the oceanic stock in some areas and may be genetically indistinguishable from those stocks. Analysis of biopsy samples obtained from bottlenose dolphins in the shelf region is scheduled for 2005-06. However, studies have shown significant genetic differentiation between inshore stocks and coastal/continental shelf stocks (Sellas 2002).

Based on research currently being conducted on bottlenose dolphins in the Gulf of Mexico, as well as the western North Atlantic Ocean, the structure of these stocks is uncertain, but appears to be complex. The multi-disciplinary research programs conducted over the last 3.5 decades (e.g., Wells 1994) have begun to shed light on the structure of some of the stocks of bottlenose dolphins, though additional analyses are needed before stock structures can be elaborated on in the Gulf of Mexico. As research is completed, it may be necessary to revise stocks of bottlenose dolphins in the Gulf of Mexico.

POPULATION SIZE

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 from 1998 to 2001 during fall plankton surveys conducted from NOAA ships *Oregon II* (1998, 1999) and *Gordon Gunter* (2000, 2001). Tracklines, which were perpendicular to the bathymetry, covered shelf waters from the 20m to the 200m isobaths (Figure 1, Table 1; Fulling *et al.* 2003). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate for both areas.

The best abundance estimate of bottlenose dolphins, pooled from 1998 through 2001, for continental shelf vessel surveys was 25,320 (CV=0.26) (Fulling *et al.* 2003). This estimate is considered the best because these surveys have the most complete coverage of the species' habitat.

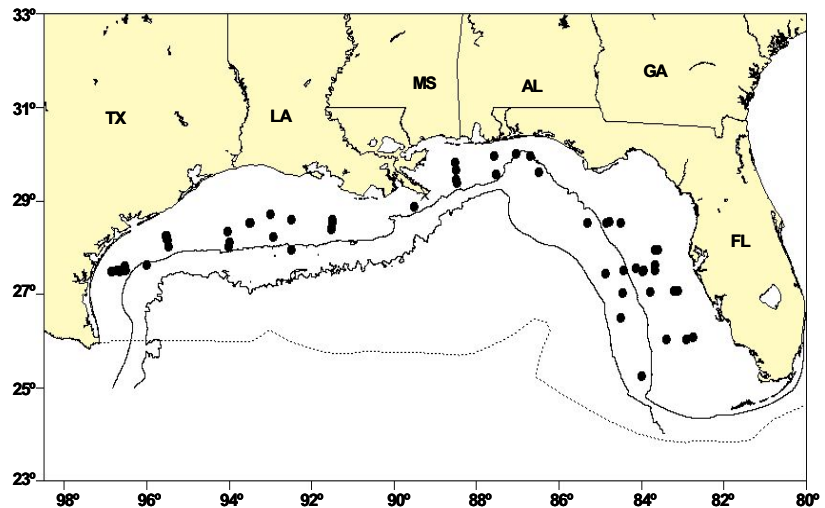


Figure 1. Distribution of bottlenose dolphin sightings from SEFSC fall vessel surveys during 1998-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line shows the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for bottlenose dolphins is 25,320 (CV=0.26). The minimum population estimate for the northern Gulf of Mexico is 20,414 bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate from the 1998-2001 ship survey of 25,320 (CV=0.26) and the previous abundance from a 1992-1994 aerial survey of 50,247 (CV=0.18) (Blaylock and Hoggard 1994) are significantly different ($P < 0.05$). However, there are a number of reasons the 2 estimates are different other than from a change in abundance. Blaylock and Hoggard (1994) estimated from aerial surveys that about 31% of the bottlenose dolphins in shelf waters west of Mobile Bay were in a rather small area from the Mississippi River Delta west to about 90.5°W. Vessel survey effort in this area was small and resulted in only 1 sighting of bottlenose dolphins. Therefore, vessel-based estimates may have underestimated the abundance of bottlenose dolphins in the western shelf. Aerial abundances were based on survey lines that extended from 9.3km past the 18m (10fm) curve to 9.3km past 183m (100fm) curve, so the area surveyed was somewhat different than from the study area (20-200m) for vessel surveys. Also, Atlantic spotted dolphins are very common in shelf waters and are similar in length and shape to bottlenose dolphins. Atlantic spotted dolphins are born without spots and become progressively more spotted with age, but young animals look very similar to bottlenose dolphins. Therefore, depending on the composition of the group, from a distance Atlantic spotted are not always easily distinguished from bottlenose dolphins, so it is possible that some groups were misidentified during aerial surveys leading to bias in the relative abundance of each 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 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 net productivity rate and a “recovery” factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 20,414 (CV=0.26). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico continental shelf bottlenose dolphin is 204.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are no observed cases of human-caused mortality and serious injury in this stock; however, based on an observed non-lethal take in U.S. Atlantic waters in 1993 in the pelagic longline fishery, this stock may be subject to incidental take resulting in serious injury or mortality. Fishery interactions have been reported to occur between bottlenose dolphins and the longline swordfish/tuna fishery in the Gulf of Mexico (SEFSC unpublished logbook data), and annual fishery-related mortality and serious injury to bottlenose dolphins was estimated to be 2.8 per year (CV=0.74) during 1992-1993. This could include bottlenose dolphins from the oceanic stock. There has been no reported fishing-related mortality of bottlenose dolphins during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of bottlenose dolphins in the northern Gulf of Mexico is unknown; however, interactions between bottlenose dolphins and fisheries have been observed in the northern Gulf of Mexico. There have been no reports of incidental mortality or injury associated with the shrimp trawl fishery in this area. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no observed incidental takes or releases of bottlenose dolphins in the Gulf of Mexico from 1997 to 2001. A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980s with no records of incidental take of marine mammals (Burn and Scott 1988; NMFS unpublished data), although an experimental set by NMFS resulted in the death of 2 bottlenose dolphins (Burn and Scott 1988). There are no other data available.

Other Mortality

The use of explosives to remove oil rigs in portions of the continental shelf in the western Gulf of Mexico has the potential to cause serious injury or mortality to marine mammals. These activities have been closely monitored by NMFS observers since 1987 (Gitschlag and Herczeg 1994). There have been no reports of either serious injury or mortality to bottlenose dolphins (NMFS unpublished data).

STATUS OF STOCK

The status of bottlenose dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Northern Gulf of Mexico Coastal Stocks

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (Mullin *et al.* 1990). Northern Gulf of Mexico coastal waters have been divided for management purposes into 3 bottlenose dolphin stocks: eastern, northern and western. As a working hypothesis, it is assumed that the dolphins occupying habitats with dissimilar climactic, coastal and oceanographic characteristics might be restricted in their movements between habitats, and thus constitute separate stocks. Coastal waters are defined as those from shore, barrier islands, or presumed bay boundaries to the 20m isobath (Figure 1). The eastern coastal bottlenose dolphin stock area extends from 84° W longitude to Key West, Florida; the northern coastal bottlenose dolphin stock area from 84° W longitude to the Mississippi River Delta; and the western coastal bottlenose dolphin stock area from the Mississippi River Delta to the Texas-Mexico border. The eastern coastal stock area is temperate to subtropical in climate, is bordered by a mixture of coastal marshes, sand beaches, marsh and mangrove islands, and has an intermediate level of freshwater input. The northern coastal stock area is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of fresh water input. The western coastal stock area is characterized by an arid to temperate climate, sand beaches in southern Texas, extensive coastal marshes in northern Texas and Louisiana, and low to high levels of fresh water input.

Portions of the coastal stocks may co-occur with the northern Gulf of Mexico continental shelf stock and bay, sound and estuary stocks, and the western coastal stock is trans-boundary with Mexico. The seaward boundary for coastal stocks, the 20m isobath, generally corresponds to survey strata (Scott *et al.* 1990; Blaylock and Hoggard 1994; Fulling *et al.* 2003), and thus represents a management boundary rather than an ecological boundary. Both “coastal/nearshore” and “offshore” ecotypes of bottlenose dolphins (Hersh and Duffield 1990) occur in the Gulf of Mexico (LeDuc and Curry 1998), and both could potentially occur in coastal waters. The offshore and coastal ecotypes are genetically distinct using both mitochondrial and nuclear markers (Hoelzel *et al.* 1998). In the northwestern Atlantic Ocean, Torres *et al.* (2003) found a statistically significant break in the distribution of the ecotypes at 34km from shore. The offshore ecotype was found exclusively seaward of 34km and in waters deeper than 34m. Within 7.5km of shore, all animals were of the coastal ecotype. The distance of the 20m isobath ranges from 4 to 90km from shore in the northern Gulf. However, because the continental shelf is much wider in the Gulf, results from the Atlantic may not apply. About 180 genetic samples are available to help assess whether the continental shelf and coastal stocks should be separated, and if so, where. Analysis of these samples is scheduled for 2005-06. Research on coastal stocks is limited. Sellas (2002) found significant genetic differentiation between Sarasota Bay resident dolphins and those occurring primarily in adjacent Gulf coastal waters. Fazioli and Wells (1999) conducted photo-identification surveys of coastal waters off Sarasota Bay over 14 months. They found coastal waters were inhabited by both ‘inshore’ and ‘Gulf’ dolphins but that the 2 types used coastal waters differently. While they found a mixture of ranging patterns (seasonal residency, transience), they did find some dolphins displayed many of the community structure characteristics of inshore dolphins. Similar findings were reported by Quintana-Rizzo and Wells (2001) for coastal waters of Cedar Key, Florida. Off Galveston, Texas, Beier (2001) reported an open population of individual dolphins in coastal waters, but several individual dolphins had been sighted previously by other researchers over a 10-year period. Some coastal animals may move relatively long distances alongshore. Two bottlenose dolphins previously seen in the South Padre Island area in Texas were seen in Matagorda Bay, 285km north, in May 1992 and May 1993 (Lynn 1995).

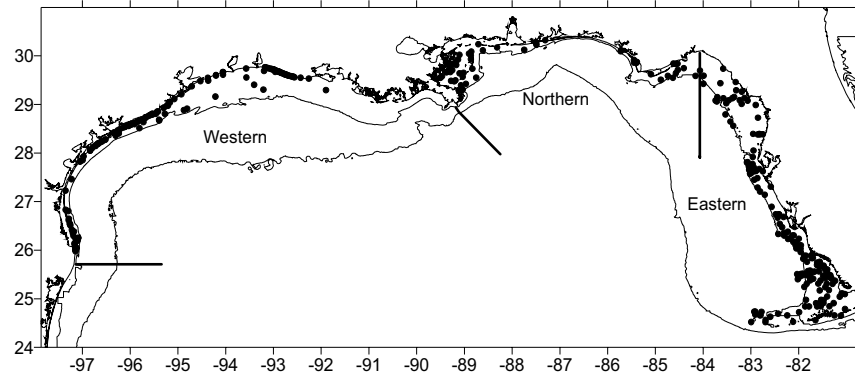


Figure 1. Locations of bottlenose dolphin groups sighted in coastal waters during aerial surveys in 1992-1994. The 20 and 200 m isobaths are shown.

POPULATION SIZE

Population size has not been estimated for the 3 coastal stocks for more than 8 years and therefore the current population size is unknown for each (Wade and Angliss 1997). Previous estimates of abundance were derived using distance sampling analysis (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) with sighting data collected during aerial line-transect surveys conducted during autumn from 1992-1994 (Blaylock and Hoggard 1994; NMFS unpublished data). Systematic sampling transects, placed randomly with respect to the bottlenose dolphin distribution, extended orthogonally from shore out to approximately 9km past the 18m isobath. Approximately 5% of the total survey area was visually searched. Previous bottlenose dolphin abundance estimates for each stock based on the 1991-1994 surveys are listed in Table 1.

Table 1. Previous bottlenose dolphin abundance (N_{BEST}), coefficient of variation (CV), and minimum population estimate (N_{MIN}) for northern Gulf of Mexico coastal bottlenose dolphin stocks. Because they are based on data collected more than 8 years ago, all estimates are currently considered unknown. PBR - Potential Biological Removal, UNK - unknown.					
Gulf of Mexico Stock Area	N_{BEST}	CV	N_{MIN}	PBR	Year
Eastern	9,912	0.12	8,963	UNK	1994
Northern	4,191	0.21	3,518	UNK	1993
Western	3,499	0.21	2,938	UNK	1992

Minimum Population Estimate

The current minimum population size for each stock is unknown. The previous minimum population estimates for each stock based on the 1992-1994 surveys are listed in Table 1. The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997).

Current Population Trend

There are insufficient data to determine population trends for these stocks.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for these stocks. 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 currently unknown for each stock. PBR is the product of minimum population size, one-half the maximum productivity rate and a "recovery" factor (Wade and Angliss 1997). The "recovery" factor, which accounts for endangered, depleted and threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the stocks are of unknown status.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

A total of 1,377 bottlenose dolphins were found stranded in the northern Gulf of Mexico from 1999 through 2003 (Table 2) (NMFS unpublished data). Of these, 73 or 5% showed evidence of human interactions as the cause of death (e.g., gear entanglement, mutilation, gunshot wounds). Bottlenose dolphins are known to become entangled in recreational and commercial fishing gear (Wells and Scott 1994; Wells *et al.* 1998; Gorzelany 1998), and some are struck by recreational and commercial vessels (Wells and Scott 1997).

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a nearby bay, sound and estuary stock; however, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcass originated. Stranding data probably underestimate the extent of human-related mortality and serious injury because not all of the dolphins which die or are seriously injured due to human interactions wash ashore, nor will all of those that do wash ashore necessarily show signs of fishery-interaction or other human interactions. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of human interaction, and the condition of the carcass if badly decomposed can inhibit the interpretation of cause of death.

The Gulf of Mexico menhaden fishery was observed to take 9 bottlenose dolphins (3 fatally) between 1992 and 1995 (NMFS unpublished data). During that period, there were 1,366 sets observed out of 26,097 total sets, which if extrapolated for all years suggests that as many as 172 bottlenose dolphins could have been taken in this fishery with up to

57 animals killed. Without an observer program it is not possible to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the communities from which bottlenose dolphins are being taken.

Feeding or provisioning, and swimming with wild bottlenose dolphins have been documented in Florida, particularly near Panama City Beach in the Panhandle. Feeding wild dolphins is defined under the MMPA as a form of 'take' because it can alter their natural behavior and increase their risk of injury or death. Nevertheless, Samuels and Bejder (2004) observed a high rate of uncontrolled provisioning near Panama City beach in 1998. The effects of swim-with activities on dolphins and their legality under the MMPA are less clear and are currently under review. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to provisioning.

Table 2. Bottlenose dolphin strandings in the U.S. Gulf of Mexico (West Florida to Texas) from 1999 to 2003. Data are from the Southeast Marine Mammal Stranding Database (SESUS). Percent of animals with human interactions were calculated based on animals which were determined as "yes" or "no" for human interactions. Animals that were "CBD" (could not be determined) were excluded from % with human interactions calculations.

State		1999	2000	2001	2002	2003	Total
Florida	No. Stranded	156	130	57	82 ^a	64 ^d	483
	No. Human Interactions	5	8	2	6	7	28
	No. CBD	106	76	26	44	34	286
	% With Human Interactions	10%	15%	6%	16%	23%	14%
Alabama	No. Stranded	12	15	17	12	7	63
	No. Human Interactions	0	0	2	0	1	3
	No. CBD	8	7	8	9	4	36
	% With Human Interactions	0%	0%	22%	0%	33%	11%
Mississippi	No. Stranded	25	27	22	21 ^b	37 ^c	126
	No. Human Interactions	0	1	0	0	0	1
	No. CBD	17	15	8	6	29	75
	% With Human Interactions	0%	8%	0%	0%	0%	2%
Louisiana	No. Stranded	25	14	0	2	33 ^f	69
	No. Human Interactions	1	0	-	0	0	1
	No. CBD	19	14	-	2	29	64
	% With Human Interactions	17%	CBD	-	CBD	0%	20%
Texas	No. Stranded	102	113	116	154 ^c	154 ^g	636
	No. Human Interactions	2	7	6	15	10	40
	No. CBD	40	47	5	57	101	250
	% With Human Interactions	3%	11%	5%	15%	19%	10%
Totals	No. Stranded	320	299	212	271	295	1377
	No. Human Interactions	8	16	10	21	18	73
	No. CBD	190	159	47	118	197	711
	% With Human Interactions	6%	11%	6%	14%	18%	11%
a	Florida mass stranding of 2 animals in December 2002						
b	Mississippi mass stranding of 2 animals in March 2002						
c	Texas mass strandings (2 animals in January 2002, 2 animals in March 2002)						
d	Florida mass stranding of 2 animals in May 2003						
e	Mississippi mass stranding of 2 animals in April 2003						
f	Louisiana mass stranding of 3 animals in July 2003						
g	Texas mass stranding of 5 animals in March 2003						

Fisheries Information

The commercial fisheries which potentially could interact with coastal stocks in the northern Gulf of Mexico are the shrimp trawl, blue crab trap/pot, stone crab trap/pot, menhaden and gillnet fisheries (Appendix I). Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery. Bottlenose dolphins have been reported stranded with polypropylene rope around their flukes (NMFS 1991; McFee and Brooks, Jr. 1998; NMFS unpublished data), indicating the possibility of entanglement with crab pot lines. The blue crab fishery has not been monitored by observers and there are no estimates of bottlenose dolphin mortality or serious injury for this fishery. There is no observer program data for the menhaden fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). No marine mammal mortalities associated with gillnet fisheries have been reported, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious injury.

Other Mortality

The nearshore habitat occupied by these 3 stocks is adjacent to areas of high human population and in some areas, such as the Tampa Bay, Florida; Galveston, Texas; and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such as PCB's and DDT and its metabolites vary from site to site, and can reach levels of concern for bottlenose dolphin health and reproduction in the southeastern U.S. (Schwacke *et al.* 2002). PCB concentrations in 3 stranded dolphins sampled from the eastern coastal stock area ranged from 16-46 μ g/g wet weight. Two stranded dolphins from the northern coastal stock area had the highest levels of DDT derivatives of any of the bottlenose dolphin liver samples analyzed in conjunction with a 1990 mortality investigation conducted by NMFS (Varanasi *et al.* 1992). The significance of these findings is unclear, but there is some evidence that increased exposure to anthropogenic compounds may reduce immune function in bottlenose dolphins (Lahvis *et al.* 1995). Concentrations of chlorinated hydrocarbons and metals were relatively low in most of the bottlenose dolphins examined in conjunction with an anomalous mortality event in Texas bays in 1990; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). Agricultural runoff following periods of high rainfall in 1992 was implicated in a high level of bottlenose dolphin mortalities in Matagorda Bay, which is adjacent to the western coastal stock area (NMFS unpublished data).

The Mississippi River, which drains about two-thirds of the continental U.S., flows into the north-central Gulf of Mexico and deposits its nutrient load which is linked to the formation of 1 of the world's largest areas of seasonal hypoxia (Rabalais *et al.* 1999). This area is located in Louisiana coastal waters west of the Mississippi River delta. How it affects bottlenose dolphins is not known.

Since 1990, there have been 6 bottlenose dolphin die-offs in the northern Gulf of Mexico. From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). In March and April 1992, 111 bottlenose dolphins stranded in Texas; about 9 times the average number. Seven of 34 live-captured bottlenose dolphins (20%) in 1992 from Matagorda Bay, Texas, tested positive for previous exposure to cetacean morbillivirus and it is possible that other stocks have been exposed to the morbillivirus (Duignan *et al.* 1996).

In 1992, NOAA Fisheries' Working Group on Unusual Marine Mortality Events was formalized and developed protocols to declare Unusual Mortality Events (UME) and respond to them. Since 1992, 4 UMEs involving bottlenose dolphins have been investigated in the northern Gulf of Mexico. In 1993-1994 a UME of bottlenose dolphins caused by morbillivirus started in the Florida Panhandle and spread west with most of the mortalities occurring in Texas (Lipscomb 1993; Lipscomb *et al.* 1994). In 1996 a UME was declared for bottlenose dolphins in Mississippi and while the cause was not determined, *Karenia brevis* (red tide) was suspected. Between August 1999 and February 2000, at least 120 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle. In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 107 bottlenose dolphins stranded dead (NMFS 2004).

STATUS OF STOCK

The status of each stock relative to OSP is not known and population trends cannot be determined due to insufficient data. This species is not listed as threatened or endangered under the Endangered Species Act. The total known human-related mortality and serious injury for each stock cannot be assessed relative to PBR because the PBR is unknown for each stock, and therefore cannot be considered to be insignificant and approaching zero mortality and serious injury rate. Each is a strategic stock because the known level of human-related mortality or serious injury relative to PBR is unknown. Also, there is no systematic monitoring of all fisheries that may take these stocks. Insufficient information is available to determine whether the total fishery mortality and serious injury for coastal bottlenose dolphin stocks is insignificant and

approaching zero mortality and serious injury rate. The potential impact, if any, of coastal pollution may be an issue for this species in portions of its habitat, though little is known on this to date.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Northern Gulf of Mexico Oceanic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Thirty-eight stocks have been provisionally identified for Gulf of Mexico bottlenose dolphins (Waring *et al.* 2001). Gulf of Mexico inshore habitat has been separated into 33 bay, sound and estuarine stocks. Three northern Gulf of Mexico coastal stocks include nearshore waters from the shore to the 20 m isobath. The continental shelf stock encompasses waters from 20 to 200m deep. The Gulf of Mexico oceanic stock encompasses the waters from the 200 m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ; Figure 1).

Both “coastal/nearshore” and “offshore” ecotypes of bottlenose dolphins (Hersh and Duffield 1990) occur in the Gulf of Mexico (LeDuc and Curry 1998) but the distribution of each is not known. The offshore and nearshore ecotypes are genetically distinct using both mitochondrial and nuclear markers (Hoelzel *et al.* 1998). In the northwestern Atlantic Ocean, Torres *et al.* (2003) found a statistically significant break in the distribution of the ecotypes at 34km from shore. The offshore ecotype was found exclusively seaward of 34 km and in waters deeper than 34m. The continental shelf is much wider in the Gulf of Mexico and these results may not apply.

Based on research currently being conducted on bottlenose dolphins in the Gulf of Mexico, as well as the western North Atlantic Ocean, the structure of these stocks is uncertain, but appears to be complex. The multi-disciplinary research programs conducted over the last 3.5 decades (e.g., Wells 1994) are beginning to shed light on stock structures of bottlenose dolphins, though additional analyses are needed before stock structures can be elaborated on in the Gulf of Mexico. As research is completed, it may be necessary to revise stocks of bottlenose dolphins in the Gulf of Mexico.

POPULATION SIZE

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. Surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Tracklines, which were perpendicular to the bathymetry, covered the waters from 200m to the offshore extent of the U.S. EEZ. Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for bottlenose dolphins in oceanic waters, pooled from 1996 to 2001, is 2,239 (CV=0.41) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the oceanic Gulf of Mexico.

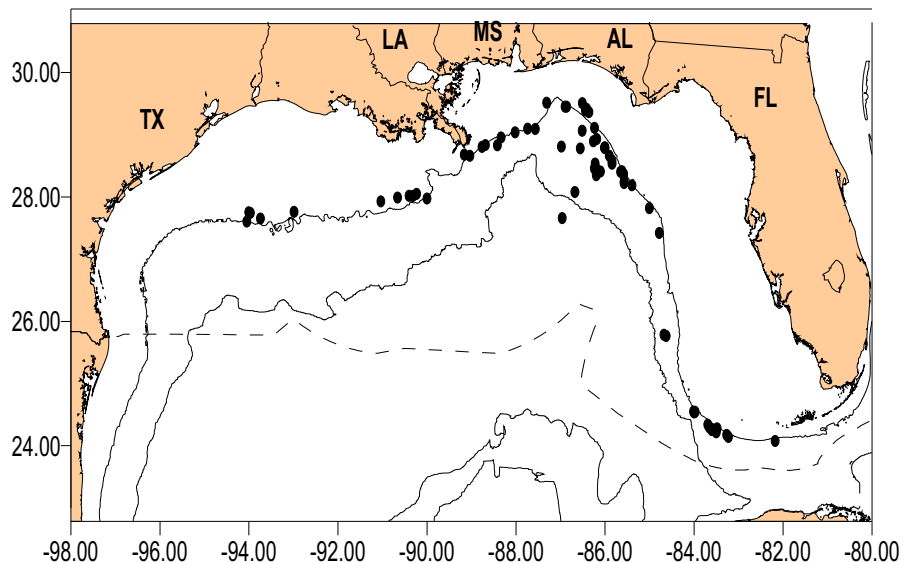


Figure 1. Distribution of bottlenose dolphin sightings from SEFSC shipboard surveys during spring 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 200 m and 2,000 m isobaths, and the dotted line indicates the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for bottlenose dolphins is 2,239 (CV=0.41) taken from Mullin and Fulling (2004). The minimum population estimate for the northern Gulf of Mexico oceanic stock is 1,607 bottlenose dolphins.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum productivity rates are unknown for this stock. For purposes of this assessment, the maximum 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 level (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 1,607 (CV=0.41). 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 the stock is of unknown status. PBR for the Gulf of Mexico oceanic bottlenose dolphin is 16.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Annual human-caused mortality and serious injury is unknown for this stock.

Fisheries Information

The level of past or current, direct, human-caused mortality of bottlenose dolphins in the Gulf of Mexico is unknown; however, interactions between bottlenose dolphins and fisheries have been observed in the Gulf of Mexico. There have been no reports of incidental mortality or injury associated with the shrimp trawl fishery in this area. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to bottlenose dolphins in the Gulf of Mexico during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004). Fishery interactions have previously been reported to occur between bottlenose dolphins and the longline swordfish/tuna fishery in the Gulf of Mexico (SEFSC unpublished logbook data), with annual fishery-related mortality and serious injury to bottlenose dolphins estimated to be 2.8 per year (CV=0.74) during 1992-1993. This could include bottlenose dolphins from the continental shelf and oceanic stocks. One animal was hooked in the mouth and released by pelagic longline fishery in 1998 (Yeung 1999).

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980s with no records of incidental take of marine mammals (Burn and Scott 1988; NMFS unpublished data), although an experimental set by NMFS resulted in the death of 2 bottlenose dolphins (Burn and Scott 1988). There are no other data available with regard to this fishery.

Other Mortality

The use of explosives to remove oil rigs in portions of the continental shelf in the western Gulf of Mexico has the potential to cause serious injury or mortality to marine mammals. These activities have been closely monitored by NMFS observers since 1987 (Gitschlag and Herczeg 1994). There have been no reports of either serious injury or mortality to bottlenose dolphins in the oceanic Gulf of Mexico (NMFS unpublished data).

STATUS OF STOCK

The status of bottlenose dolphins, relative to OSP, in the U.S. Gulf of Mexico oceanic waters 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because annual fishery-related mortality and serious injury does not exceed PBR.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus*): Gulf of Mexico Bay, Sound, and Estuarine Stocks

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the Gulf of Mexico (Mullin 1988). The identification of biologically-meaningful “stocks” of bottlenose dolphins in these waters is complicated by the high degree of behavioral variability exhibited by this species (Shane *et al.* 1986; Wells and Scott 1999; Wells 2003), and by the lack of requisite information for much of the region.

Distinct stocks are provisionally identified in each of 33 areas of contiguous, enclosed or semi-enclosed bodies of water adjacent to the Gulf of Mexico (Table 1, based on descriptions of relatively discrete dolphin “communities” in some of these areas. A “community” includes resident dolphins that regularly share large portions of their ranges, exhibit similar distinct genetic profiles, and interact with each other to a much greater extent than with dolphins in adjacent waters. The term, as adapted from Wells *et al.* (1987), emphasizes geographic, genetic and social relationships of dolphins. Bottlenose dolphin communities do not constitute closed demographic populations, as individuals from adjacent communities are known to interbreed. Nevertheless, the geographic nature of these areas and long-term stability of residency patterns suggest that many of these communities exist as functioning units of their ecosystems, and under the Marine Mammal Protection Act must be maintained as such. Also, the stable patterns of residency observed within communities suggest that long periods would be required to repopulate the home range of a community were it eradicated or severely depleted. Thus, in the absence of information supporting management on a larger scale, it is appropriate to adopt a risk-averse approach and focus management efforts at the level of the community rather than at some larger demographic scale. Biological support for this risk-averse approach derives from several sources. Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification or tagging studies have been conducted in the Gulf of Mexico. In Texas, some of the dolphins in the Matagorda-Espiritu Santo Bay area (Gruber 1981; Lynn and Würsig 2002), Aransas Pass (Shane 1977; Weller 1998), San Luis Pass (Maze and Würsig 1999; Irwin and Würsig 2004), and Galveston Bay (Bräger 1993; Bräger *et al.* 1994; Fertl 1994) have been reported as long-term residents. Hubard *et al.* (2004) reported sightings of dolphins tagged 12-15 years previously in Mississippi Sound. In Florida, long-term residency has been reported from Choctawhatchee Bay (1989-1993), Tampa Bay (Wells 1986a; Wells *et al.* 1996a), Sarasota Bay (Irvine and Wells 1972; Irvine *et al.* 1981; Wells 1986a, 1991; Scott *et al.* 1990; Wells *et al.* 1987; Wells 2003), Lemon Bay (Wells *et al.* 1996b) and Charlotte Harbor/Pine Island Sound (Shane 1990; Wells *et al.* 1996b, 1997; Shane 2004). In Louisiana, Miller (2004) concluded the bottlenose dolphin population in the Barataria Basin was relatively closed. In many cases, residents emphasize use of the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977, 1990; Gruber 1981; Irvine *et al.* 1981; Maze and Würsig 1999; Fazioli and Wells 1999; Lynn and Würsig 2002). These habitat use patterns are reflected in the ecology of the dolphins in some areas; for example, residents of Sarasota Bay, Florida, lacked squid in their diet, unlike non-resident dolphins stranded on nearby Gulf beaches (Barros and Wells 1998).

Genetic data also support the concept of relatively discrete bay, sound and estuary stocks. Analyses of mitochondrial DNA haplotype distributions indicate the existence of clinal variations along the Gulf of Mexico coastline (Duffield and Wells 2002). Differences in reproductive seasonality from site to site also suggest genetic-based distinctions between communities (Urian *et al.* 1996). Mitochondrial DNA analyses suggest finer-scale structural levels as well. For example, Matagorda Bay, Texas, dolphins appear to be a localized population, and differences in haplotype frequencies distinguish between adjacent communities in Tampa Bay, Sarasota Bay and Charlotte Harbor/Pine Island Sound, along the central west coast of Florida (Duffield and Wells 1991 2002). Examination of protein electrophoretic data resulted in similar conclusions for the Florida dolphins (Duffield and Wells 1986). Additionally, Sellas (2002) found significant genetic differentiation between Sarasota Bay resident dolphins and those occurring primarily in adjacent Gulf coastal waters.

The long-term structure and stability of at least some of these communities is exemplified by the residents of Sarasota Bay, Florida. This community has been observed since 1970 (Irvine and Wells 1972; Scott *et al.* 1990; Wells 1991). At least 4 generations of identifiable residents currently inhabit the region, including one-third of those first identified in 1970. Maximum immigration and emigration rates of about 2-3% have been estimated (Wells and Scott 1990).

Genetic exchange occurs between resident communities; hence the application of the demographically and behaviorally-based term “community” rather than “population” (Wells 1986a; Sellas *et al.* in review). Some of the calves in Sarasota Bay apparently have been sired by non-residents (Duffield and Wells 2002). A variety of potential exchange mechanisms occur in the Gulf. Small numbers of inshore dolphins traveling between regions have been reported, with patterns ranging from traveling through adjacent communities (Wells 1986b; Wells *et al.* 1996a,b) to movements over distances of several hundred km in Texas waters (Gruber 1981; Würsig and Lynn 1996). In many areas year-round residents co-occur with non-resident dolphins, providing potential opportunities for genetic exchange. About 17% of group sightings involving resident Sarasota Bay dolphins include at least 1 non-resident as well (Wells *et al.* 1987). Similar mixing of inshore residents and non-residents is seen off San Luis Pass, Texas (Maze and Würsig 1999), and Pine

Island Sound, Florida (Shane 2004). Non-residents exhibit a variety of patterns, ranging from apparent nomadism recorded as transience in a given area, to apparent seasonal or non-seasonal migrations. Passes, especially the mouths of the larger estuaries, serve as mixing areas. For example, several communities mix at the mouth of Tampa Bay, Florida (Wells 1986a), and most of the dolphins identified in the mouths of Galveston Bay and Aransas Pass, Texas, were considered transients (Henningsen 1991; Bräger 1993; Weller 1998).

Seasonal movements of dolphins into and out of some of the bays, sounds and estuaries provide additional opportunities for genetic exchange with residents, and complicate the identification of stocks in coastal and inshore waters. In small bay systems such as Sarasota Bay, Florida, and San Luis Pass, Texas, residents move into Gulf coastal waters in fall/winter, and return inshore in spring/summer (Irvine *et al.* 1981; Maze and Würsig 1999). In larger bay systems, seasonal changes in abundance suggest possible migrations, with increases in more northerly bay systems in summer, and in more southerly systems in winter. Fall/winter increases in abundance have been noted for Tampa Bay (Scott *et al.* 1989) and Charlotte Harbor/Pine Island Sound (Thompson 1981; Scott *et al.* 1989), and are thought to occur in Matagorda Bay (Gruber 1981; Lynn 1995; Würsig and Lynn 1996) and Aransas Pass (Shane 1977; Weller 1998). Spring/summer increases in abundance occur in Mississippi Sound (Hubard *et al.* 2004) and are thought to occur in Galveston Bay (Henningsen 1991; Bräger 1993; Fertl 1994).

Much uncertainty remains regarding the structure of bottlenose dolphin stocks in many of the Gulf of Mexico bays, sounds and estuaries. Given the apparent co-occurrence of resident and non-resident dolphins in these areas, and the demonstrated variations in abundance, it appears that consideration should be given to the existence of a complex of stocks, and to the roles of bays, sounds and estuaries for stocks emphasizing Gulf of Mexico coastal waters. A starting point for management strategy should be the protection of the long-term resident communities, with their multi-generational geographic, genetic, demographic and social stability. These localized units would be at greatest risk from geographically-localized impacts. Complete characterization of many of these basic units would benefit from additional photo-identification, telemetry and genetic research (Wells 1994).

The current provisional stocks follow the designations in Table 1, with a few revisions. Available information suggests that Block B35, Little Sarasota Bay, can be subsumed under Sarasota Bay, and B36, Caloosahatchee River, can be considered a part of Pine Island Sound. As more information becomes available, additional combination or division may be warranted. For example, a number of geographically and socially distinct subgroupings of dolphins in regions such as Tampa Bay, Charlotte Harbor, Pine Island Sound, Aransas Pass and Matagorda Bay have been identified, but the importance of these distinctions to stock designations remain undetermined (Shane 1977; Gruber 1981; Wells *et al.* 1996a,b, 1997; Lynn and Würsig 2002; Urian 2002).

Understanding the full complement of the stock complex using the bay, sound and estuarine waters of the Gulf of Mexico will require much additional information. The development of biologically-based criteria to better define and manage stocks in this region should integrate multiple approaches, including studies of ranging patterns, genetics, morphology, social patterns, distribution, life history, stomach contents, isozyme analyses and contaminant concentrations. Spatially-explicit population modeling could aid in evaluating the implications of community-based stock definition. As these studies provide new information on what constitutes a bottlenose dolphin "biological stock," current provisional definitions will likely need to be revised. As stocks are more clearly identified, it will be possible to conduct abundance estimates using standardized methodology across sites (thereby avoiding some of the previous problems of mixing results of aerial and boat-based surveys), identify fisheries and other human impacts relative to specific stocks and perform individual stock assessments. As recommended by the Atlantic Scientific Review Group (November 1998, Portland, Maine), an expert panel reviewed the stock structure for bottlenose dolphins in the Gulf of Mexico during a workshop in March 2000 (Hubard and Swartz 2002). The panel sought to describe the scope of risks faced by bottlenose dolphins in the Gulf of Mexico, and outline an approach by which the stock structure could most efficiently be investigated and integrated with data from previous and ongoing studies. The panel agreed that it was appropriate to use the precautionary approach and retain the stocks currently named until further studies are conducted, and made a variety of recommendations for future research (Hubard and Swartz 2002). As a result of this, efforts are being made to conduct research in new locations, such as the central Gulf, in addition to the ongoing studies in Texas and Florida.

Table 1. Previous bottlenose dolphin abundance (N_{BEST}), coefficient of variation (CV) and minimum population estimate (N_{MIN}) in U.S. Gulf of Mexico bays, sounds and estuaries. Because they are based on data collected more than 8 years ago, all estimates are considered unknown for management purposes. Blocks refer to 33 aerial survey blocks illustrated in Figure 1. PBR - Potential Biological Removal; UNK - unknown.							
Blocks	Gulf of Mexico Estuary	N_{BEST}	CV	N_{MIN}	PBR	Year	Reference
B51	Laguna Madre	80	1.57	31	UNK	1992	A
B52	Nueces Bay, Corpus Christi Bay	58	0.61	36	UNK	1992	A
B50	Compano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay	55	0.82	30	UNK	1992	A
B54	Matagorda Bay, Tres Palacios Bay, Lavaca Bay	61	0.45	42	UNK	1992	A
B55	West Bay	32	0.15	28	0.3	2000	E
B56	Galveston Bay, East Bay, Trinity Bay	152	0.43	107	UNK	1992	A
B57	Sabine Lake	0 ^a	-		UNK	1992	A
B58	Calcasieu Lake	0 ^a	-		UNK	1992	A
B59	Vermillion Bay, West Cote Blanche Bay, Atchafalaya Bay	0 ^a	-		UNK	1992	A
B60	Terrebonne Bay, Timbalier Bay	100	0.53	66	UNK	1993	A
B61	Barataria Bay	138	0.08	129	1.3	2001	D
B30	Mississippi River Delta	0 ^l	-		UNK	1993	A
B02-05, 29,31	Bay Boudreau, Mississippi Sound	1,401	0.13	1,256	UNK	1993	A
B06	Mobile Bay, Bonsecour Bay	122	0.34	92	UNK	1993	A
B07	Perdido Bay	0 ^a	-		UNK	1993	A
B08	Pensacola Bay, East Bay	33	0.80	18	UNK	1993	A
B09	Choctawhatchee Bay	242	0.31	188	UNK	1993	A
B10	St. Andrew Bay	124	0.57	79	UNK	1993	A
B11	St. Joseph Bay	0 ^a	-		UNK	1993	A
B12-13	St. Vincent Sound, Apalachicola Bay, St. Georges Sound	387	0.34	293	UNK	1993	A
B14-15	Apalachee Bay	491	0.39	358	UNK	1993	A
B16	Waccasassa Bay, Withlacoochee Bay, Crystal Bay	100	0.85	54	UNK	1994	A
B17	St. Joseph Sound, Clearwater Harbor	37	1.06	18	UNK	1994	A
B32-34	Tampa Bay	559	0.24	458	UNK	1994	A
B20	Sarasota Bay	97	na ^c	97	UNK	1992	B
B35	Little Sarasota Bay	2 ^b	0.24	2	UNK	1985	C
B21	Lemon Bay	0 ^a	-		UNK	1994	A
B22-23	Pine Sound, Charlotte Harbor, Gasparilla Sound	209	0.38	153	UNK	1994	A
B36	Caloosahatchee River	0 ^{a,b}	-		UNK	1985	C
B24	Estero Bay	104	0.67	62	UNK	1994	A
B25	Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay	208	0.46	144	UNK	1994	A
B27	Whitewater Bay	242	0.37	179	UNK	1994	A
B28	Florida Keys (Bahia Honda to Key West)	29	1.00	14	UNK	1994	A

References: A- Blaylock and Hoggard 1994; B- Wells 1992; C- Scott *et al.* 1989; D- Miller 2003; E- Irwin and Würsig 2004

Notes:

a During earlier surveys (Scott *et al.* 1989), the range of seasonal abundances was as follows: B57, 0-2 (CV= 0.38); B58, 0-6 (0.34); B59, 0-0; B30, 0-182(0.14); B07, 0-0; B21, 0-15(0.43); and B36, 0-0.

b Block not surveyed during surveys reported in Blaylock and Hoggard 1994.

c No CV because NBEST was a direct count of known individuals.

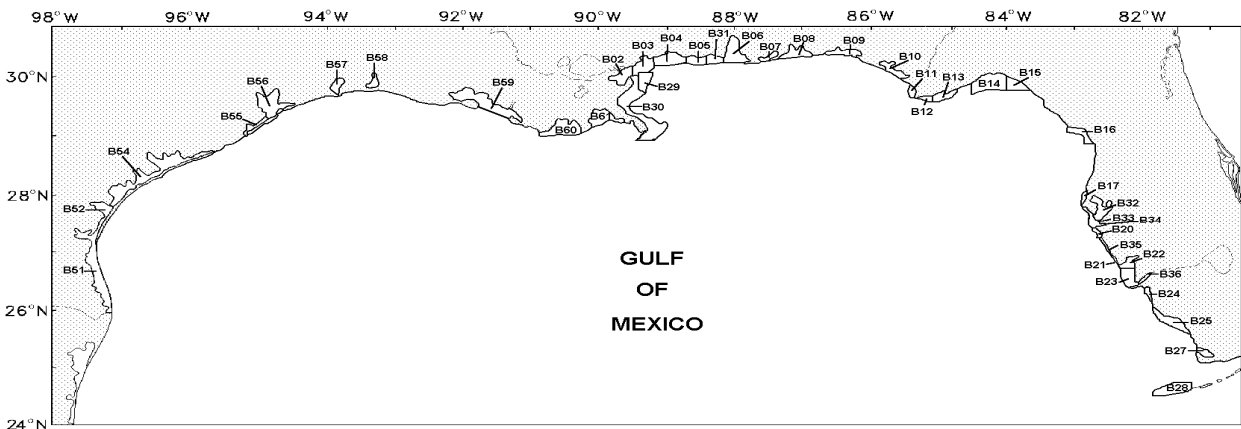


Figure 1. U.S.A Gulf of Mexico bays and sounds. Each of the alpha-numerically designated blocks corresponds to one of the NMFS Southeast Fisheries Science Center logistical aerial survey areas listed in Table 1. The bottlenose dolphins inhabiting each bay and sound are considered to comprise a unique stock for purposes of this assessment.

POPULATION SIZE

Population size estimates for most of the stocks are greater than 8 years old and therefore the current population size for each stock is considered unknown (Wade and Angliss 1997). Recent mark-recapture population size estimates are available for West Bay, Texas, and Barataria Bay, Louisiana (Table 1). Previous population size (Table 1) was estimated from preliminary analyses of line-transect data collected during aerial surveys conducted in September-October 1992 in Texas and Louisiana; in September-October 1993 in Louisiana, Mississippi, Alabama and the Florida panhandle (Blaylock and Hoggard 1994); and in September-November 1994 along the west coast of Florida (NMFS unpublished data). Standard line-transect perpendicular sighting distance analytical methods (Buckland *et al.* 1993) and the computer program DISTANCE (Laake *et al.* 1993) were used. Stock size in Sarasota Bay, Florida, was obtained through direct count of known individuals (Wells 1992).

Minimum Population Estimate

The population size for most stocks is currently unknown. The recent or the previous minimum population estimates are given for each stock in Table 1. The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The minimum population estimate was calculated for each block from the estimated population size and its associated coefficient of variation. Where the population size resulted from a direct count of known individuals, the minimum population size was identical to the estimated population size.

Current Population Trend

The data are insufficient to determine population trends for all of the Gulf of Mexico bay, sound and estuary bottlenose dolphin communities. The Sarasota Bay community, however, has been monitored since 1970 and has remained relatively constant through 1997 at approximately 105 animals (Wells 1998). Six anomalous mortality events have occurred among portions of these dolphin communities between 1990 and 2004; however, it is not possible to accurately partition the mortalities between bay and coastal stocks, thus the impact of these mortality events on communities is not known.

For Barataria Bay, Louisiana, Miller (2004) estimated a population size ranging from 138 to 238 bottlenose dolphins (95% CI = 128-297) using mark-recapture techniques with data collected from June 1999 to May 2002. The previous estimate for Barataria Bay from 1994, 219 dolphins, falls at the high end of this range. Irwin and Würsig (2004) estimated annual population sizes ranging from 28 to 38 dolphins during 1997-2001 for the San Luis Pass/Chocolate portion of West Bay, Texas, where the previous estimate from 1992 was 29 dolphins.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the dolphin communities that comprise these stocks. While productivity rates may be estimated for individual females within communities, such estimates are confounded at the stock level due to the influx of dolphins from adjacent areas which balance losses, and the unexplained loss of some individuals which offset births and recruitment (Wells 1998). Continued monitoring and expanded survey coverage will

be required to address and develop estimates of productivity for these dolphin communities. 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 unknown for most stocks because the population size estimate is more than 8 years old. PBR is the product of minimum population size, one-half the maximum productivity rate and a “recovery” factor (Wade and Angliss 1997). The “recovery” factor, which accounts for endangered, depleted, and threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because these stocks are of unknown status. PBR for those stocks with population size estimates less than 8 years old is given in Table 1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There are a number of difficulties associated with the interpretation of stranding data. It is possible that some or all of the stranded dolphins may have been from a nearby coastal stock; however, the proportion of stranded dolphins belonging to another stock cannot be determined because of the difficulty of determining from where the stranded carcasses originated. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the dolphins which die or are seriously injured in fishery interactions 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, and the condition of the carcass if badly decomposed can inhibit the interpretation of cause of death.

A total of 1,377 bottlenose dolphins were found stranded in the U.S. Gulf of Mexico from 1999 through 2003 (Table 2) (NMFS unpublished data). Of these, 73 or 11% showed evidence of human interactions as the cause of death (e.g., gear entanglement, mutilation, gunshot wounds). Bottlenose dolphins are known to become entangled in recreational and commercial fishing gear (Wells and Scott 1994; Wells *et al.* 1998; Gorzelany 1998) and some are struck by recreational and commercial vessels (Wells and Scott 1997). In 1998 alone, 2 resident bottlenose dolphins and an associated calf were killed by vessel strikes and a resident young-of-the-year died from entanglement in a crab-pot float line (R.S. Wells, pers. comm.).

The Gulf of Mexico menhaden fishery was observed to take 9 bottlenose dolphins (3 fatally) between 1992 and 1995 (NMFS unpublished data). During that period, there were 1,366 sets observed out of 26,097 total sets, which if extrapolated for all years suggests that as many as 172 bottlenose dolphins could have been taken in this fishery with up to 57 animals killed. Without an observer program it is not possible to obtain statistically reliable information for this fishery on the number of sets annually, the incidental take and mortality rates, and the communities from which bottlenose dolphins are being taken.

Some of the bay, sound and estuarine communities were the focus of a live-capture fishery for bottlenose dolphins which supplied dolphins to the U.S. Navy and to oceanaria for research and public display for more than 2 decades ending in 1989 (NMFS unpublished data). During the period 1972-89, 490 bottlenose dolphins, an average of 29 dolphins annually, were removed from a few locations in the Gulf of Mexico, including the Florida Keys. Mississippi Sound sustained the highest level of removals with 202 dolphins taken from this stock during this period, representing 41% of the total and an annual average of 12 dolphins (compared to a previous PBR of 13). The annual average number of removals never exceeded previous PBR levels, but it may be biologically significant that 73% of the dolphins removed during 1982-88 were females. The impact of those removals on the stocks is unknown.

Feeding or provisioning, and swimming with wild bottlenose dolphins have been documented in Florida, particularly near Panama City Beach in the Panhandle. Feeding wild dolphins is defined under the MMPA as a form of ‘take’ because it can alter their natural behavior and increase their risk of injury or death. Nevertheless, Samuels and Bejder (2004) observed a high rate of uncontrolled provisioning near Panama City Beach in 1998. The effects of swim-with activities on dolphins and their legality under the MMPA are less clear and are currently under review. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to provisioning.

Fishery Information

The commercial fisheries which potentially could interact with these stocks in the Gulf of Mexico are the shrimp trawl, blue crab trap/pot, stone crab trap/pot, menhaden and gillnet fisheries (Appendix I). Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery. Bottlenose dolphins have been reported stranded with polypropylene rope around their flukes (NMFS 1991; McFee and Brooks, Jr. 1998; NMFS unpublished data), indicating the possibility of entanglement with crab pot lines. The blue crab fishery has not been monitored by observers and there are no estimates of bottlenose dolphin mortality or serious injury for this fishery. There is no observer program data for the menhaden fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). No marine mammal mortalities associated with gillnet fisheries have been reported, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious

injury. In 1995, a Florida state constitutional amendment banned gillnets and large nets from bay, sounds, estuaries and other inshore waters.

Table 2. Bottlenose dolphin strandings in the U.S. Gulf of Mexico (West Florida to Texas) from 1999 to 2003. Data are from the Southeast Marine Mammal Stranding Database (SESUS). Percent of animals with human interactions were calculated based on animals which were determined as “yes” or “no” for human interactions. Animals that were “CBD” (could not be determined) were excluded from % with human interactions calculations.

State		1999	2000	2001	2002	2003	Total
Florida	No. Stranded	156	130	57	82 ^a	64 ^d	483
	No. Human Interactions	5	8	2	6	7	28
	No. CBD	106	76	26	44	34	286
	% With Human Interactions	10%	15%	6%	16%	23%	14%
Alabama	No. Stranded	12	15	17	12	7	63
	No. Human Interactions	0	0	2	0	1	3
	No. CBD	8	7	8	9	4	36
	% With Human Interactions	0%	0%	22%	0%	33%	11%
Mississippi	No. Stranded	25	27	22	21 ^b	37 ^e	126
	No. Human Interactions	0	1	0	0	0	1
	No. CBD	17	15	8	6	29	75
	% With Human Interactions	0%	8%	0%	0%	0%	2%
Louisiana	No. Stranded	25	14	0	2	33 ^f	69
	No. Human Interactions	1	0	-	0	0	1
	No. CBD	19	14	-	2	29	64
	% With Human Interactions	17%	CBD	-	CBD	0%	20%
Texas	No. Stranded	102	113	116	154 ^c	154 ^g	636
	No. Human Interactions	2	7	6	15	10	40
	No. CBD	40	47	5	57	101	250
	% With Human Interactions	3%	11%	5%	15%	19%	10%
Totals	No. Stranded	320	299	212	271	295	1377
	No. Human Interactions	8	16	10	21	18	73
	No. CBD	190	159	47	118	197	711
	% With Human Interactions	6%	11%	6%	14%	18%	11%
a	Florida mass stranding of 2 animals in December 2002						
b	Mississippi mass stranding of 2 animals in March 2002						
c	Texas mass strandings (2 animals in January 2002, 2 animals in March 2002)						
d	Florida mass stranding of 2 animals in May 2003						
e	Mississippi mass stranding of 2 animals in April 2003						
f	Louisiana mass stranding of 3 animals in July 2003						
g	Texas mass stranding of 5 animals in March 2003						

Other Mortality

The nearshore habitat occupied by many of these stocks is adjacent to areas of high human population, and in some bays, such as Mobile Bay in Alabama and Galveston Bay in Texas, is highly industrialized. The area surrounding Galveston Bay, for example, has a coastal population of over 3 million people. More than 50% of all chemical products manufactured in the U.S. are produced there and 17% of the oil produced in the Gulf of Mexico is refined there

(Henningsen and Würsig 1991). Many of the enclosed bays in Texas are surrounded by agricultural lands which receive periodic pesticide applications.

Concentrations of chlorinated hydrocarbons and metals were examined in conjunction with an anomalous mortality event of bottlenose dolphins in Texas bays in 1990 and found to be relatively low in most; however, some had concentrations at levels of possible toxicological concern (Varanasi *et al.* 1992). No studies to date have determined the amount, if any, of indirect human-induced mortality resulting from pollution or habitat degradation. Since 1990, there have been 6 bottlenose dolphin die-offs in the northern Gulf of Mexico. From January through May 1990, a total of 367 bottlenose dolphins stranded in the northern Gulf of Mexico. Overall this represented a two-fold increase in the prior maximum recorded strandings for the same period, but in some locations (i.e., Alabama) strandings were 10 times the average number. The cause of the 1990 mortality event could not be determined (Hansen 1992). In March and April 1992, 111 bottlenose dolphins stranded in Texas; about 9 times the average number. Seven of 34 live-captured bottlenose dolphins (20%) in 1992 from Matagorda Bay, Texas, tested positive for previous exposure to cetacean morbillivirus, and it is possible that other estuarine resident stocks have been exposed to the morbillivirus (Duignan *et al.* 1996).

In 1992, NOAA Fisheries' Working Group on Unusual Marine Mortality Events was formalized and developed protocols to declare Unusual Mortality Events (UME) and respond to them. Since 1992, 4 UMEs involving bottlenose dolphins have been investigated in the Gulf of Mexico. In 1993-1994 a UME of bottlenose dolphins caused by morbillivirus started in the Florida Panhandle and spread west with most of the mortalities occurring in Texas (Lipscomb 1993; Lipscomb *et al.* 1994). In 1996 a UME was declared for bottlenose dolphins in Mississippi and while the cause was not determined, *Karenia brevis* (red tide) was suspected. Between August 1999 and February 2000, at least 120 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle. In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 107 bottlenose dolphins stranded dead (NMFS 2004).

An old, sick dolphin died in a health assessment research project during 2002, the first such loss during capture/release research conducted over a 32 year period on Florida's west coast.

STATUS OF STOCK

The status of these stocks relative to OSP is unknown and this species is not listed as threatened or endangered under the Endangered Species Act. The occurrence of 6 anomalous mortality events among bottlenose dolphins along the U.S. Gulf of Mexico coast since 1990 (NMFS unpublished data) is cause for concern; however, the effects of the mortality events on stock abundance have not yet been determined.

The relatively high number of bottlenose dolphin deaths which occurred during the mortality events since 1990 suggests that some of these stocks may be stressed. Human-caused mortality and serious injury for each of these stocks is not known, but considering the evidence from stranding data (Table 2), the total human-caused mortality and serious injury exceeds 10% of the total known PBR or previous PBR, and, therefore, it is probably not insignificant and approaching the zero mortality and serious injury rate. For these reasons, each of these stocks is a strategic stock.

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ATLANTIC SPOTTED DOLPHIN (*Stenella frontalis*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin (*Stenella frontalis*) 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 200m 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.

The Atlantic spotted dolphin is endemic to the Atlantic Ocean in temperate to tropical waters (Perrin *et al.* 1987, 1994). In the Gulf of Mexico, Atlantic spotted dolphins occur primarily from continental shelf waters 10-200m deep to slope waters <500m deep (Fulling *et al.* 2003; Mullin and Fulling 2004). Atlantic spotted dolphins were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico from 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2003). It has been suggested that this species may move inshore seasonally during spring, but data supporting this hypothesis are limited (Caldwell and Caldwell 1966; Fritts *et al.* 1983).

In a recent study, Bero (2001) presented strong genetic support for differentiation between Gulf of Mexico and western North Atlantic management stocks using both mitochondrial and nuclear markers. However, this study did not test for further population subdivision within the Gulf of Mexico.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of Atlantic spotted dolphins for all surveys combined was 3,213 (CV=0.44) (Hansen *et al.* 1995). This is probably an underestimate and should be considered a partial stock estimate because the continental shelf was not entirely covered during these surveys. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Data were collected from 1996 to 2001 during spring and fall plankton surveys conducted from NOAA ships *Oregon II* (1996, 1997, 1999, 2000) and *Gordon Gunter* (1998, 2000, 2001). Tracklines, which were perpendicular to the bathymetry, covered shelf waters from the 20m to the 200m isobaths in the fall of 1998 and 1999 (Figure 1, Table 1; Fulling *et al.* 2003). Surveys were also conducted from April to May 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico from 200m to the offshore extent of the U.S. EEZ. Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1, Table 1; Mullin

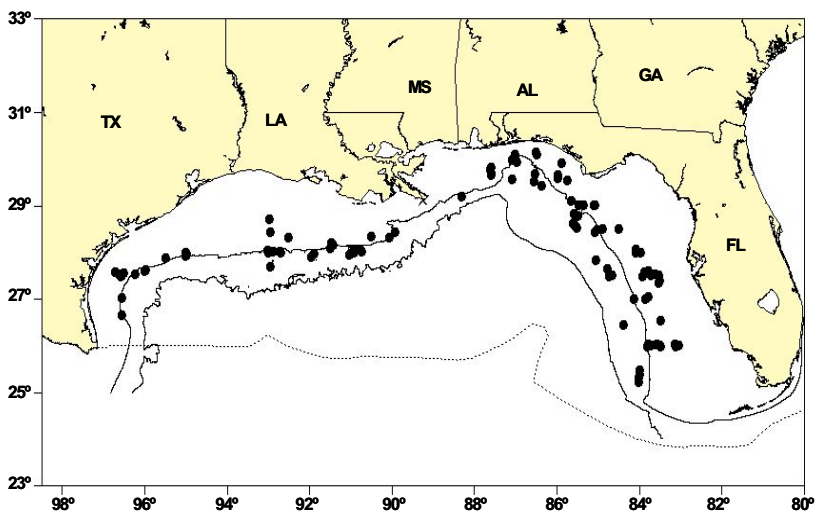


Figure 1. Distribution of Atlantic spotted dolphin sightings from SEFSC spring and fall vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the dotted line shows the offshore extent of the U.S. EEZ.

and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate for both areas.

Table 1. Abundance estimates (N_{best}) and Coefficient of Variation (CV) of Atlantic spotted dolphins in the northern U.S. Gulf of Mexico outer continental shelf (OCS) (waters 20-200m deep) during fall 1998-2001 and oceanic waters (200m to the offshore extent of the EEZ) during spring 1996-2001 (excluding 1998).			
Month/Year	Area	N_{best}	CV
Fall 1998-2001	Outer Continental Shelf	30,772	0.27
Spring 1996-2001	Oceanic	175	0.84
Spring & Fall 1996-2001	OCS & Oceanic	30,947	0.27

The combined estimated abundance of Atlantic spotted dolphins, pooled from 1998 through 2001, for the outer continental shelf shipboard surveys was 30,772 (CV=0.27) (Fulling *et al.* 2003). The estimate of abundance for Atlantic spotted dolphins in oceanic waters, pooled from 1996 through 2001, is 175 (CV=0.84) (Mullin and Fulling 2004).

The best available abundance estimate for the Atlantic spotted dolphin in the northern Gulf of Mexico is the combined estimate of abundance for both the outer continental shelf and oceanic waters from 1996 to 2001, which is 30,947 (CV=0.27). This estimate is considered the best because these surveys have the most complete coverage of the species' habitat.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Atlantic spotted dolphins is 30,947 (CV=0.27). The minimum population estimate for the northern Gulf of Mexico is 24,752 Atlantic spotted dolphins.

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. 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 net productivity rate and a "recovery" factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 24,752. 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 the stock is of unknown status. PBR for the northern Gulf of Mexico Atlantic spotted dolphin is 248.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a spotted dolphin during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of Atlantic spotted dolphins in the northern Gulf of Mexico is unknown; however, interactions between spotted dolphins and fisheries have been observed in the northern Gulf of Mexico. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were 2 observed incidental takes and releases of spotted dolphins in the Gulf of Mexico during 1994, but no recent reported takes of Atlantic spotted dolphins by this fishery in the Gulf of Mexico. Either spotted dolphin species may have been involved in the observed fishery-related mortality and serious injury incidents, but because of the uncertainty in species identification by fishery observers, they cannot currently be separated. Estimated average annual

fishing-related mortality and serious injury of spotted dolphins attributable to this fishery during 1991-1993 was 1.5 annually (CV=0.33).

Other Mortality

A total of 7 Atlantic spotted dolphins stranded in the Gulf of Mexico during 1999-2003 (Table 2). There were no indications of human interactions in any of these stranded animals. There were 2 documented strandings of Atlantic spotted dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	1	1
Florida	2	2	0	0	1	5
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	1	0	0	0	1
Total	2	3	0	0	2	7

STATUS OF STOCK

The status of Atlantic spotted dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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PANTROPICAL SPOTTED DOLPHIN (*Stenella attenuata*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are two species of spotted dolphin in the Atlantic Ocean, the Atlantic spotted dolphin (*Stenella frontalis*) 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 200m 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.

The pantropical spotted dolphin is distributed worldwide in tropical and some sub-tropical oceans (Perrin *et al.* 1987; Perrin and Hohn 1994). Sightings of this species occur in oceanic waters of the northern Gulf of Mexico (Mullin and Fulling 2004). Pantropical spotted dolphins were seen 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).

Some of the Pacific Ocean populations have been divided into different geographic stocks based on morphological characteristics (Perrin *et al.* 1987; Perrin and Hohn 1994). The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of pantropical spotted dolphins for all surveys combined was 31,320 (CV=0.20) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for pantropical spotted dolphins in oceanic waters, pooled from 1996 to 2001, is 91,321 (CV=0.16) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

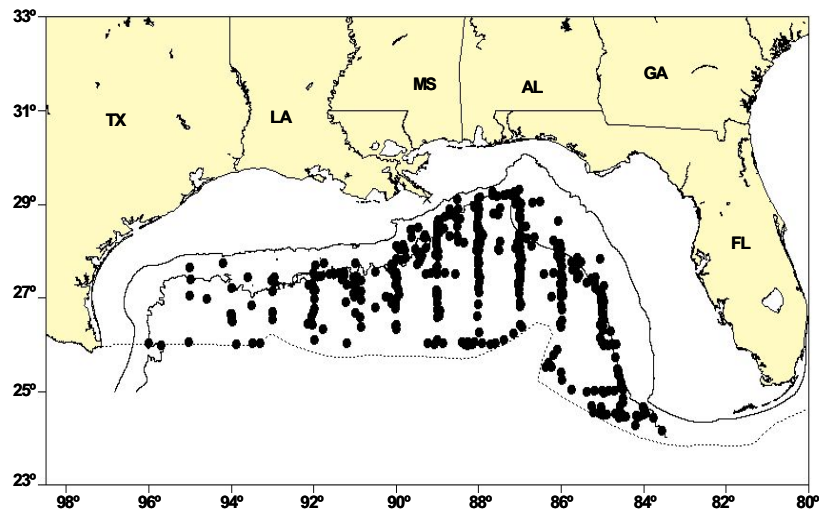


Figure 1. Distribution of pantropical spotted dolphin sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for pantropical spotted dolphins is 91,321 (CV=0.16). The minimum population estimate for the northern Gulf of Mexico is 79,879 pantropical spotted dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 91,321 (CV=0.16) and that for 1991-1994 of 31,320 (CV=0.20) are significantly different ($P<0.05$). This change in abundance is difficult to interpret without a Gulf of Mexico-wide understanding of pantropical spotted dolphin abundance. Sixty-five percent of the oceanic waters in the Gulf of Mexico are south of the U.S. EEZ, and a shift in distribution across this boundary would not be detected.

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 net productivity rate, and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 79,879 (CV=0.16). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico pantropical spotted dolphin is 799.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There was 1 documented stranding of a pantropical spotted dolphin in the northern Gulf of Mexico during 1987-1994 which was classified as likely caused by fishery interactions. There has been no reported fishing-related mortality of pantropical spotted dolphins during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of pantropical spotted dolphins in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to pantropical spotted dolphins by this fishery during 1998-2003.

Other Mortality

Four pantropical spotted dolphins stranded in the Gulf of Mexico during 1999-2003 (Table 1). There was no evidence of human interactions for the stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	0	0
Florida	0	0	0	1	1	2
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	1	0	1	0	0	2
Total	1	0	1	1	1	4

STATUS OF STOCK

The status of pantropical spotted dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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STRIPED DOLPHIN (*Stenella coeruleoalba*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The striped dolphin is distributed worldwide in tropical to temperate oceanic waters (Leatherwood and Reeves 1983; Perrin *et al.* 1994). Sightings of these animals in the northern Gulf of Mexico occur in oceanic waters (Mullin and Fulling 2004). Striped dolphins were seen 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 Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of striped dolphins for all surveys combined was 4,858 (CV=0.44) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for striped dolphins in oceanic waters, pooled from 1996 to 2001, is 6,505 (CV=0.43) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for striped dolphins is 6,505 (CV=0.43). The minimum population estimate for the northern Gulf of Mexico is 4,599 striped dolphins.

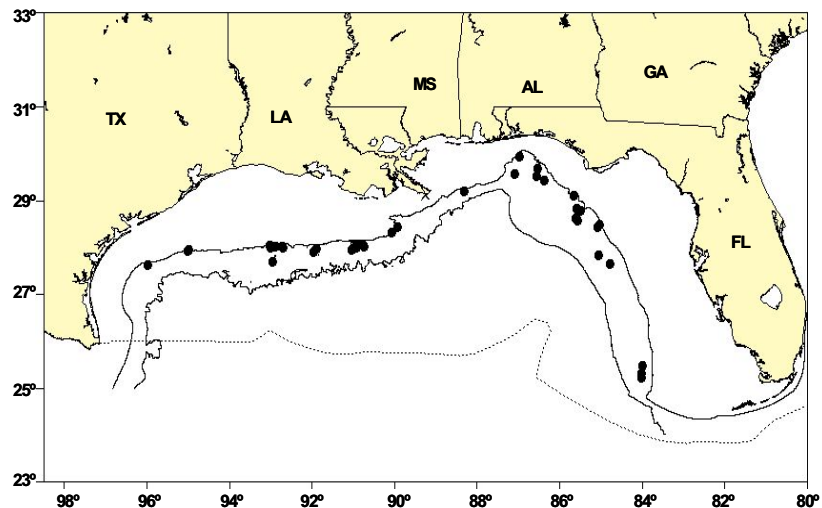


Figure 1. Distribution of striped dolphin sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 6,505 (CV=0.43) and that for 1991-1994 of 4,858 (CV=0.44) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 4,599 (CV=0.43). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico striped dolphin is 46.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of striped dolphins during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of striped dolphins in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to striped dolphins by this fishery.

Other Mortality

There was 1 reported stranding of a striped dolphin in the Gulf of Mexico during 1999-2003. There was no evidence of human interaction for this stranded animal. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of striped dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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SPINNER DOLPHIN (*Stenella longirostris*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The spinner dolphin is distributed worldwide in tropical to temperate oceanic waters (Leatherwood and Reeves 1983; Perrin and Gilpatrick 1994). Sightings of these animals in the northern Gulf of Mexico occur in oceanic waters (Mullin and Fulling 2004). Spinner dolphins were seen 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 Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of spinner dolphins for all surveys combined was 6,316 (CV=0.43) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for spinner dolphins in oceanic waters, pooled from 1996 to 2001, is 11,971 (CV=0.71) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for spinner dolphins is 11,971 (CV=0.71). The minimum population estimate for the northern Gulf of Mexico is 6,990 spinner dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 11,971 (CV=0.71) and that for 1991-1994 of 6,316 (CV=0.43) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

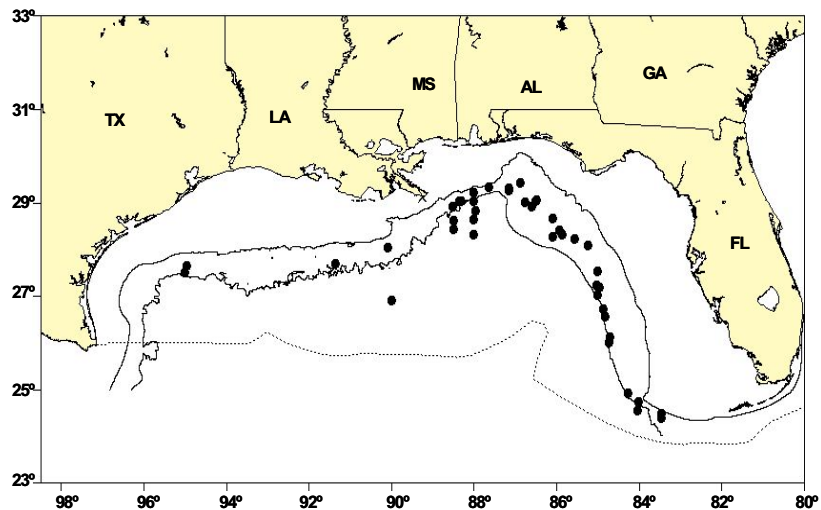


Figure 1. Distribution of spinner dolphin sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 6,990 (CV=0.71). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico spinner dolphin is 70.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of spinner dolphins during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of spinner dolphins in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to spinner dolphins by this fishery.

Other Mortality

There were 5 reported strandings of spinner dolphins in the Gulf of Mexico during 1999-2003 (Table 1). There was evidence of human interaction for 1 of the 2003 Texas stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

Table 1. Spinner dolphin (*Stenella longirostris*) strandings along the U.S. Gulf of Mexico coast, 1999-2003.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	2	2
Florida	0	0	0	0	0	0
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	1	0	0	2	3
Total	0	1	0	0	4	5

STATUS OF STOCK

The status of spinner dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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ROUGH-TOOTHED DOLPHIN (*Steno bredanensis*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The rough-toothed dolphin is distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves 1983; Miyazaki and Perrin 1994). Rough-toothed dolphins occur in both oceanic and continental shelf waters in the northern Gulf of Mexico (Fulling *et al.* 2003; Mullin and Fulling 2004). Rough-toothed dolphins were seen 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 Gulf of Mexico population is provisionally being considered 1 stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of rough-toothed dolphins for all surveys combined was 852 (CV= 0.31) (Hansen *et al.* 1995). This was probably an underestimate and should be considered a partial stock estimate because the continental shelf areas were not entirely covered by either the vessel or GulfCet aerial surveys. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Data were collected from 1996 to 2001 during spring and fall plankton surveys conducted from NOAA ships *Oregon II* (1996, 1997, 1999, 2000) and *Gordon Gunter* (1998, 1999, 2000, 2001). Tracklines, which were perpendicular to the bathymetry, covered shelf waters from 20 to 200 m deep in the fall of 1998 and 1999 (Figure 1 and Table 1; Fulling *et al.* 2003). Surveys were also conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico from 200m to the offshore extent of the U.S. EEZ. Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1 and Table 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate for both continental shelf and oceanic waters.

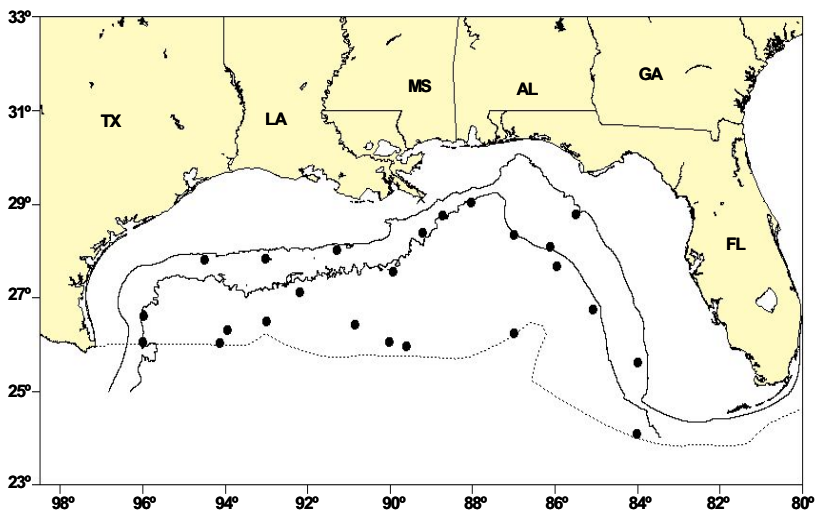


Figure 1. Distribution of rough-toothed dolphin sightings from SEFSC spring and fall vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line shows the offshore extent of the U.S. EEZ.

Table 1. Abundance estimates (N_{best}) and Coefficient of Variation (CV) of rough-toothed dolphins in the northern U.S. Gulf of Mexico outer continental shelf (OCS) (waters 20-200 m deep) during fall 1998-2001 and oceanic waters (200m to the offshore extent of the EEZ) during spring 1996-2001 (excluding 1998).			
Month/Year	Area	N_{best}	CV
Fall 1998-2001	Outer Continental Shelf	1,238	0.65
Spring 1996-2001	Oceanic	985	0.44
Spring & Fall 1996-2001	OCS & Oceanic	2,223	0.41

The combined estimated abundance of rough-toothed dolphins, pooled from 1998 through 2001, for the outer continental shelf shipboard surveys was 1,238 (CV=0.65) (Fulling *et al.* 2003). The estimate of abundance for rough-toothed dolphins in oceanic waters, pooled from 1996 through 2001, is 985 (CV=0.44) (Mullin and Fulling 2004).

The best available abundance estimate for the rough-toothed dolphin in the northern Gulf of Mexico is the combined estimate of abundance for both the outer continental shelf and oceanic waters from 1996 to 2001, which is 2,223 (CV=0.41). This estimate is considered the best because these surveys have the most complete coverage of the species' habitat. This species was observed in shelf waters, with 2 sightings occurring off the coast of Texas and 1 sighting off the southern Florida Panhandle (Fulling *et al.* 2003). Group sizes recorded for rough-toothed dolphins in shelf waters were 8, 11 and 20 individuals.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for rough-toothed dolphins is 2,223 (CV=0.41). The minimum population estimate for the northern Gulf of Mexico is 1,595 rough-toothed dolphins.

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. 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 net productivity rate and a "recovery" factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 1,595. 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 the stock is of unknown status. PBR for the northern Gulf of Mexico rough-toothed dolphin is 16.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There were 2 documented strandings of rough-toothed dolphins in the northern Gulf of Mexico during 1987-1994 which were classified as likely caused by fishery interactions. There has been no reported fishing-related mortality of rough-toothed dolphins during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of rough-toothed dolphins in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to rough-toothed dolphins by this fishery in the Gulf of Mexico during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Other Mortality

There were 22 stranded rough-toothed dolphins in the northern Gulf of Mexico during 1999-2003, including 1 mass stranding of 19 animals in February 2001 (Table 2). There was no evidence of human interactions for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	0	0
Florida	0	1	19 ^a	1	1	22
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	0	0	0	0	0
Total	0	1	19	1	1	22

a Florida mass stranding of 19 animals in February 2001

STATUS OF STOCK

The status of rough-toothed dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR

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CLYMENE DOLPHIN (*Stenella clymene*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Clymene dolphin is endemic to tropical and sub-tropical waters of the Atlantic (Leatherwood and Reeves 1983; Perrin and Mead 1994). Sightings of these animals in the northern Gulf of Mexico occur primarily over the deeper waters off the continental shelf (Mullin *et al.* 1994). Clymene dolphins were seen in the winter, spring and summer during GulfCet aerial surveys of the northern Gulf of Mexico during 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000).

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

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of Clymene dolphins for all surveys combined was 5,571 (CV=0.37) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for Clymene dolphins in oceanic waters, pooled from 1996 to 2001, is 17,355 (CV=0.65) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Clymene's dolphins is 17,355 (CV=0.65). The minimum population estimate for the northern Gulf of Mexico is 10,528 Clymene dolphins.

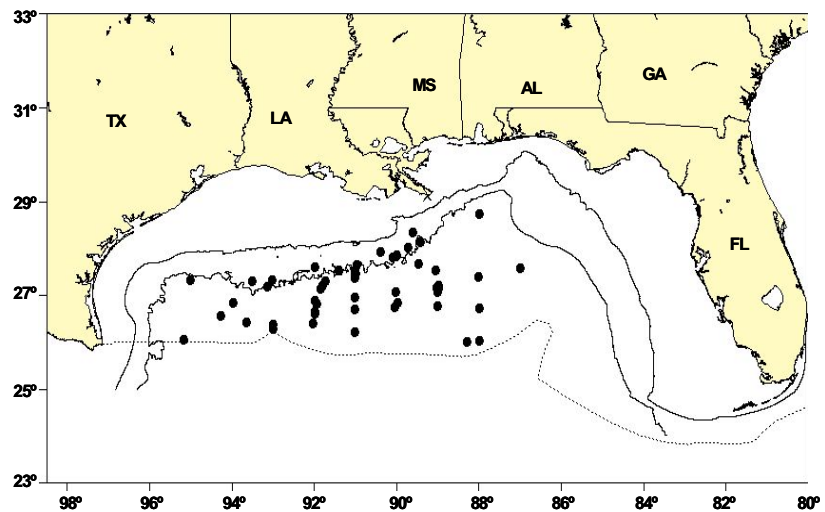


Figure 1. Distribution of *Clymene's* dolphin sightings from SEFSC shipboard spring surveys during spring between 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 17,355 (CV=0.65) and that for 1991-1994 of 5,571 (CV=0.37) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 10,528 (CV=0.65). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico Clymene dolphin is 105.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of Clymene dolphins during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of Clymene dolphins in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to Clymene dolphins by this fishery.

Other Mortality

There were 2 reported stranding events of Clymene dolphins in the Gulf of Mexico during 1999-2003. One animal stranded in Florida in July 2002, and 2 animals mass stranded in Louisiana in September 2003. 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 not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of Clymene dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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FRASER'S DOLPHIN (*Lagenodelphis hosei*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Fraser's dolphin is distributed worldwide in tropical waters (Perrin *et al.* 1994). Sightings in the northern Gulf of Mexico occur in oceanic waters (>200m) (Figure 1). Fraser's dolphins have been observed in the northern Gulf of Mexico during all seasons (Leatherwood *et al.* 1993; Hansen *et al.* 1996; Mullin and Hoggard 2000).

The Gulf of Mexico population is provisionally being considered 1 stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of Fraser's dolphins for all surveys combined was 127 (CV= 0.90) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations. Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for Fraser's dolphins in oceanic waters, pooled from 1996 to 2001, is 726 (CV=0.70) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Fraser's dolphins is 726 (CV=0.70). The minimum population estimate for the northern Gulf of Mexico is 427 Fraser's dolphins.

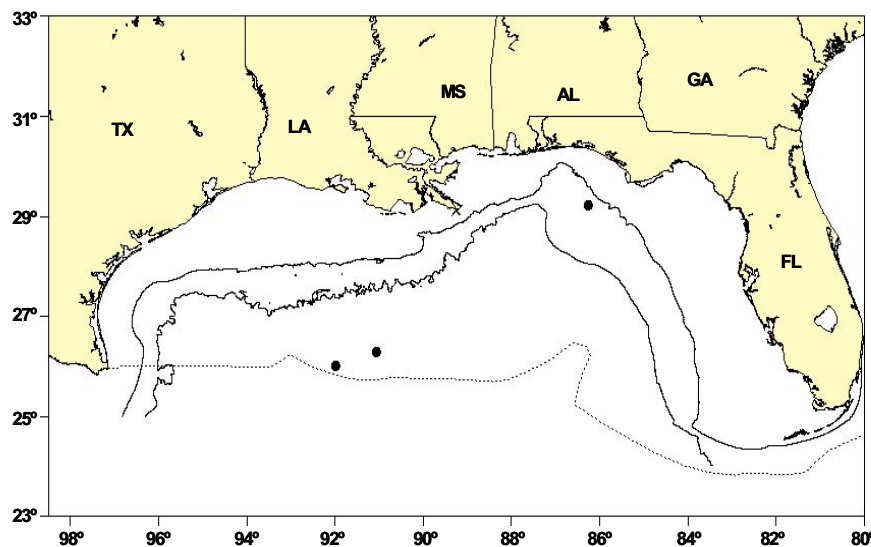


Figure 1. Distribution of Fraser's dolphin sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 726 (CV=0.70) and that for 1991-1994 of 127 (CV=0.89) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 427 (CV=0.70). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico Fraser's dolphin is 4.3.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a Fraser's dolphin during 1998-2003 (Yeung 1999, Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of Fraser's dolphins in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to Fraser's dolphins by this fishery.

Other Mortality

There was 1 reported stranding event of Fraser's dolphins in the Gulf of Mexico during 1999-2003. Ten animals mass stranded in Florida during April 2003. There was no evidence of human interaction for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of Fraser's dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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KILLER WHALE (*Orcinus orca*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The killer whale is distributed worldwide from tropical to polar regions (Leatherwood and Reeves 1983). Sightings of these animals in the northern Gulf of Mexico during 1951-1995 occurred primarily in oceanic waters ranging from 256 to 2,652m (averaging 1,242m) in the north-central Gulf of Mexico (O'Sullivan and Mullin 1997). Despite extensive shelf surveys (O'Sullivan and Mullin 1997), no killer whales have been reported on the Gulf of Mexico shelf waters other than those reported in 1921, 1985 and 1987 by Katona *et al.* (1988). Killer whales were seen only in the summer during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000), were reported from May through June during vessel surveys (Mullin and Fulling 2004) and recorded in May, August, September and November by earlier opportunistic ship-based sources (O'Sullivan and Mullin 1997).

Different stocks were identified in the northeastern Pacific based on morphological, behavioral and genetic characteristics (Bigg *et al.* 1990; Hoelzel 1991). There is no information on stock differentiation for the Atlantic Ocean population, although an analysis of vocalizations of killer whales from Iceland and Norway indicated that whales from these areas may represent different stocks (Moore *et al.* 1988). Thirty-two individuals have been photographically identified to date, with 6 individuals having been sighted over a 5 year period, and 1 whale resighted over 10 years. Three animals have been sighted over a range of more than 1,100km (O'Sullivan and Mullin 1997). The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during summer in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of killer whales for all surveys combined was 277 (CV=0.42) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for killer whales in oceanic waters, pooled from 1996 to 2001, is 133 (CV=0.49) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

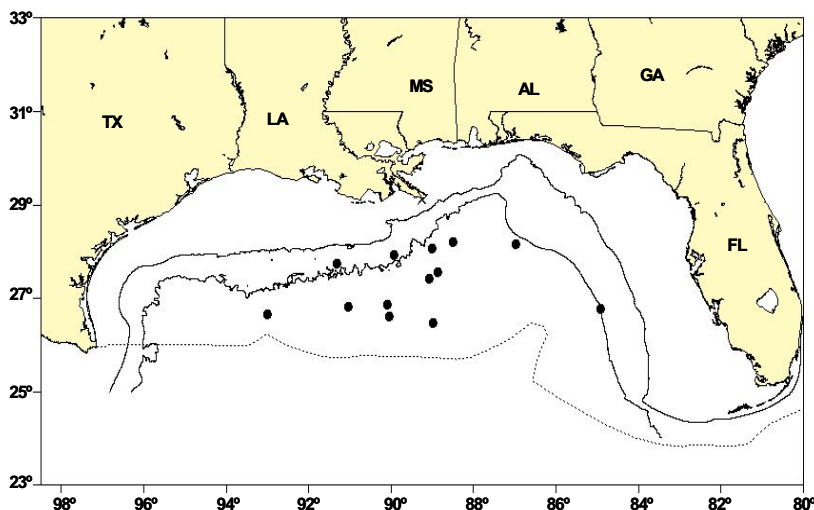


Figure 1. Distribution of killer whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for killer whales is 133 (CV=0.49). The minimum population estimate for the northern Gulf of Mexico is 90 killer whales.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 133 (CV=0.49) and that for 1991-1994 of 277 (CV=0.42) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 90 (CV=0.40). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico killer whale is 0.9.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a killer whale during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of killer whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to killer whales by this fishery.

Other Mortality

There were no reported strandings of killer whales in the Gulf of Mexico during 1999-2003. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of killer whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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FALSE KILLER WHALE (*Pseudorca crassidens*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The false killer whale is distributed worldwide throughout warm temperate and tropical oceans (Leatherwood and Reeves 1983). Sightings of this species in the northern Gulf of Mexico occur in oceanic waters (Figure 1; Mullin and Fulling 2004). False killer whales were seen only in the spring and summer during GulfCet aerial surveys of the northern Gulf of Mexico between 1992 and 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000) and in the spring during vessel surveys (Mullin and Fulling 2004).

The Gulf of Mexico population is provisionally being considered 1 stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of false killer whales for all surveys combined was 381 (CV=0.62) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for false killer whales in oceanic waters, pooled from 1996 to 2001, is 1,038 (CV=0.71) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for false killer whales is 1,038 (CV=0.71). The minimum population estimate for the northern Gulf of Mexico is 606 false killer whales.

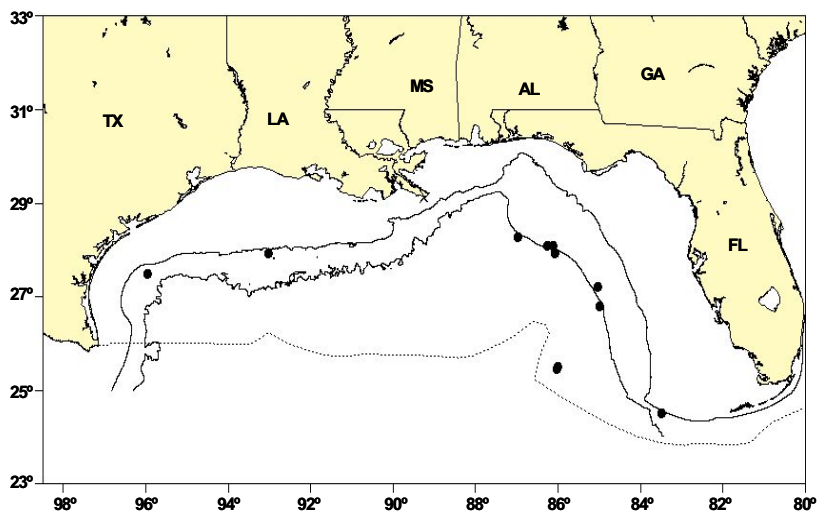


Figure 1. Distribution of false killer whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 1,038 (CV=0.71) and that for 1991-1994 of 381 (CV=0.62) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 606 (CV=0.71). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico false killer whale is 6.1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been 1 reported fishing-related mortality of a false killer whale during 1998-2003, which was a stranding in 1999 classified as likely caused by fishery interactions or other human-related causes due to mutilation of limbs (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of false killer whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to false killer whales by this fishery.

Other Mortality

There was 1 reported stranding of a false killer whale in the Gulf of Mexico during 1999-2003. This animal, which stranded in Alabama in 1999, was classified as likely caused by fishery interactions or other human-related causes. The fins and flukes of the animal had been amputated. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of false killer whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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PYGMY KILLER WHALE (*Feresa attenuata*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy killer whale is distributed worldwide in tropical and subtropical waters (Ross and Leatherwood 1994). Sightings of these animals in the northern Gulf of Mexico occur in oceanic waters (Mullin and Fulling 2004). Sightings of pygmy killer whales 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 Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of pygmy killer whales for all surveys combined was 518 (CV=0.81) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for pygmy killer whales in oceanic waters, pooled from 1996 to 2001, is 408 (CV=0.60) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for pygmy killer whales is 408 (CV=0.60). The minimum population estimate for the northern Gulf of Mexico is 256 pygmy killer whales.

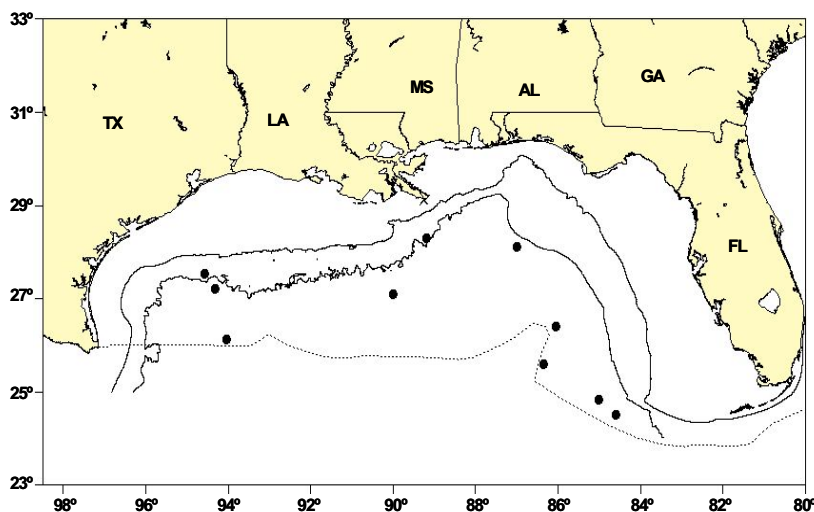


Figure 1. Distribution of pygmy killer whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 408 (CV=0.60) and that for 1991-1994 of 518 (CV=0.81) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 256 (CV=0.60). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico pygmy killer whale is 2.6.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a pygmy killer whale during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of pygmy killer whales in the northern Gulf of Mexico is unknown. There has historically been some take of this species in small cetacean fisheries in the Caribbean (Caldwell and Caldwell 1971). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to pygmy killer whales by this fishery.

Other Mortality

There was 1 reported stranding of a pygmy killer whale in the Gulf of Mexico during 1999-2003. There was no evidence of human interaction for this stranded animal. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of pygmy killer whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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DWARF SPERM WHALE (*Kogia sima*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The dwarf sperm whale appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). Sightings of these animals in the northern Gulf of Mexico occur primarily in oceanic waters (Figure 1; Mullin *et al.* 1991; Mullin and Fulling 2004). Dwarf sperm whales and pygmy sperm whales (*Kogia breviceps*) are difficult to differentiate at sea, and sightings of either species are usually categorized as *Kogia* spp. Sightings of this category were documented in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico from 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). The difficulty in sighting dwarf and pygmy sperm whales may be exacerbated by their avoidance reaction towards ships, and change in behavior towards approaching survey aircraft (Würsig *et al.* 1998).

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

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of dwarf and pygmy sperm whales for all surveys combined was 547 (CV = 0.28) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for dwarf and pygmy sperm whales in oceanic waters, pooled from 1996 to 2001, is 742 (CV=0.29) (Mullin and Fulling 2004), which is the best available abundance estimate for these species in the northern Gulf of Mexico. A separate estimate of abundance for dwarf sperm whales cannot be estimated due to uncertainty of species identification at sea.

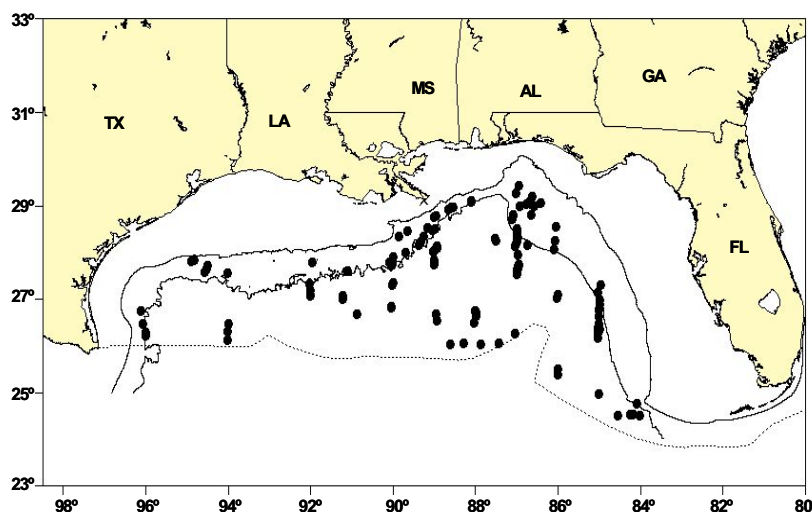


Figure 1. Distribution of dwarf and pygmy sperm whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for dwarf and pygmy sperm whales is 742 (CV=0.29). It is not possible to determine the minimum population estimate for only dwarf sperm whales. The minimum population estimate for the northern Gulf of Mexico is 584 dwarf and pygmy sperm whales.

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. 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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for dwarf and pygmy sperm whales is 574 (CV=0.29). 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 (OPSP), is assumed to be 0.5 because the stock is of unknown status. PBR for the northern Gulf of Mexico dwarf and pygmy sperm whales is 5.8. It is not possible to determine the PBR for only dwarf sperm whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of dwarf or pygmy sperm whales during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of dwarf sperm whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to dwarf sperm whales by this fishery.

Other Mortality

There were no documented strandings of dwarf sperm whales in the northern Gulf of Mexico during 1999-2003 which were classified as likely caused by fishery interactions, but there have been stranding investigation reports of dwarf sperm whales which may have died as a result of other human-related causes. At least 7 dwarf sperm whale strandings were documented in the northern Gulf of Mexico from 1999 through 2003 (Table 1; 5 showed no signs of human interaction and 2 were designated “could not be determined”). An additional 5 *Kogia* spp. stranded during this same period. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	0	0
Florida	0	2	0	3	1	6
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	0	0	1	0	1
Total	0	2	0	4	1	7

STATUS OF STOCK

The status of dwarf sperm whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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PYGMY SPERM WHALE (*Kogia breviceps*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The pygmy sperm whale appears to be distributed worldwide in temperate to tropical waters (Caldwell and Caldwell 1989). Sightings of these animals in the northern Gulf of Mexico occur primarily in oceanic waters (Figure 1; Mullin *et al.* 1991; Mullin and Fulling 2004). Pygmy sperm whales and dwarf sperm whales (*Kogia sima*) are difficult to differentiate at sea, and sightings of either species are often categorized as *Kogia* sp. Sightings of this category were documented in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico from 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). The difficulty in sighting pygmy and dwarf sperm whales may be exacerbated by their avoidance reaction towards ships, and change in behavior towards approaching survey aircraft (Würsig *et al.* 1998).

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

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of pygmy and dwarf sperm whales for all surveys combined was 547 (CV=0.28) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for pygmy and dwarf sperm whales in oceanic waters, pooled from 1996 to 2001, is 742 (CV=0.29) (Mullin and Fulling 2004), which is the best available abundance estimate for these species in the northern Gulf of Mexico. A separate estimate of abundance for pygmy sperm whales cannot be estimated due to uncertainty of species identification at sea.

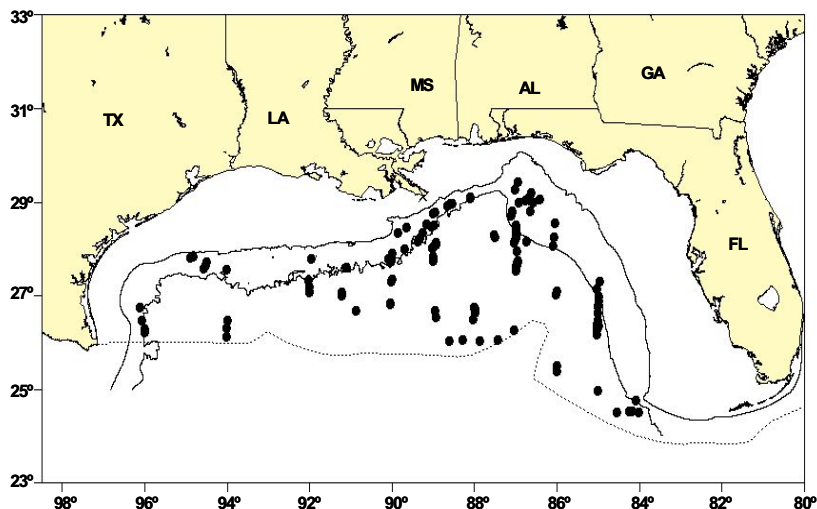


Figure 1. Distribution of pygmy and dwarf sperm whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for pygmy and dwarf sperm whales is 742 (CV=0.29). It is not possible to determine the minimum population estimate for only pygmy sperm whales. The minimum population estimate for the northern Gulf of Mexico is 584 pygmy and dwarf sperm whales.

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. 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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for pygmy and dwarf sperm whales is 584 (CV=0.29). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico pygmy and dwarf sperm whales is 5.8. It is not possible to determine the PBR for only pygmy sperm whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of dwarf or pygmy sperm whales during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of dwarf sperm whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to dwarf sperm whales by this fishery.

Other Mortality

At least 12 pygmy sperm whale strandings were documented in the northern Gulf of Mexico during 1999-2003 (Table 1; 11 showed no signs of human interaction and 1 was designated “could not be determined”). Two animals mass stranded in Florida during January 2001. An additional 5 *Kogia* spp. stranded during 1999-2003. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	0	0
Florida	0	0	2 ^a	2	3	7
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	1	1	2	1	5
Total	0	1	3	4	4	12

a Florida mass stranding of 2 animals in January 2001

STATUS OF STOCK

The status of pygmy sperm whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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MELON-HEADED WHALE (*Peponocephala electra*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The melon-headed whale is distributed worldwide in tropical to sub-tropical waters (Jefferson *et al.* 1994). Sightings in the northern Gulf of Mexico occur in oceanic waters (Mullin *et al.* 1994; Mullin and Fulling 2004). Sightings of melon-headed whales 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 Gulf of Mexico population is provisionally being considered 1 stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of melon-headed whales for all surveys combined was 3,965 (CV=0.39) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001

(excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for melon-headed whales in oceanic waters, pooled from 1996 to 2001, is 3,451 (CV=0.55) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for melon-headed whales is 3,451 (CV=0.55). The minimum population estimate for the northern Gulf of Mexico is 2,238 melon-headed whales.

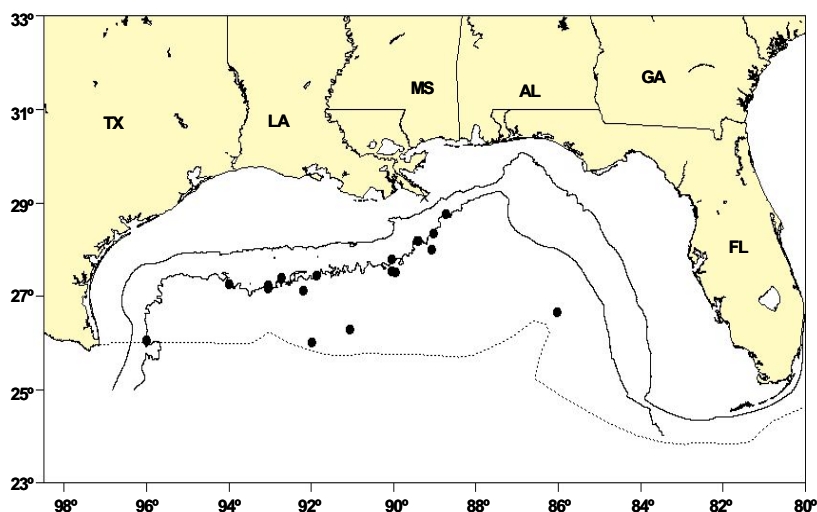


Figure 1. Distribution of melon-headed whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 3,451 (CV=0.55) and that for 1991-1994 of 3,965 (CV=0.39) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 2,238 (CV=0.55). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico melon-headed whale is 22.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a melon-headed whale during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of melon-headed whales in the northern Gulf of Mexico is unknown. There has historically been some take of this species in small cetacean fisheries in the Caribbean (Caldwell *et al.* 1976). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to melon-headed whales by this fishery.

Other Mortality

There were 6 reported strandings of melon-headed whales in the Gulf of Mexico during 1999-2003. There was no evidence of human interactions for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	2	2
Florida	0	0	0	0	0	0
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	1	0	0	2	3
Total	0	1	0	0	4	5

STATUS OF STOCK

The status of melon-headed whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but

assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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RISSO'S DOLPHIN (*Grampus griseus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphin is distributed worldwide in tropical to warm temperate waters (Leatherwood and Reeves 1983). Risso's dolphins in the northern Gulf of Mexico occur throughout oceanic waters but are concentrated in continental slope waters (Baumgartner 1997). Risso's dolphins were seen 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 Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of Risso's dolphins for all surveys combined was 2,749 (CV=0.27) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for Risso's dolphins in oceanic waters, pooled from 1996 to 2001, is 2,169 (CV=0.32) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for Risso's dolphins is 2,169 (CV=0.32). The minimum population estimate for the northern Gulf of Mexico is 1,668 Risso's dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 1,777 (CV=0.34) and that for 1991-1994 of 2,749 (CV=0.27) are not significantly different ($P>0.05$), but due to the precision of the estimates, the power to detect a difference is relatively low.

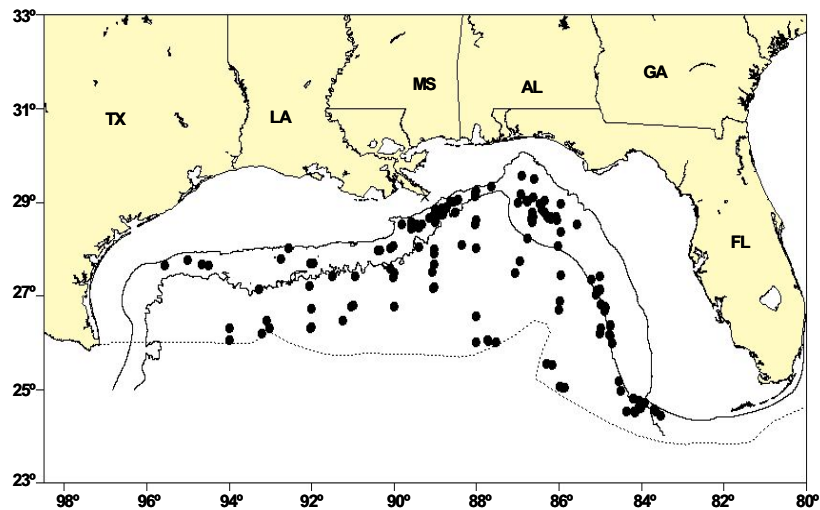


Figure 1. Distribution of Risso's dolphin sightings from SEFSC vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 1,668. 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 the stock is of unknown status. PBR for the northern Gulf of Mexico Risso’s dolphin is 17.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a Risso’s dolphin during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of Risso’s dolphins in the northern Gulf of Mexico is unknown. This species has been taken in the U.S. longline swordfish/tuna fishery in the northern Gulf of Mexico and in the U.S. Atlantic (Lee *et al.* 1994). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no reports of mortality or serious injury to Risso’s dolphins by this fishery during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004). One Risso's dolphin was observed taken and released alive during 1992; the extent of injury to the animal was unknown (SEFSC, unpublished data). One lethal take of a Risso's dolphin by the fishery was observed in the Gulf of Mexico during 1993 (SEFSC, unpublished data). Estimated average annual fishery-related mortality and serious injury attributable to the longline swordfish/tuna fishery in the Gulf of Mexico during 1992-1993 was 19 Risso’s dolphins (CV=0.20).

Other Mortality

There were 2 reported strandings of Risso’s dolphin in the Gulf of Mexico during 1999-2003. There was no evidence of human interactions for these stranded animals. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

STATUS OF STOCK

The status of Risso’s dolphins in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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SHORT-FINNED PILOT WHALE (*Globicephala macrorhynchus*): Northern Gulf of Mexico Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The short-finned pilot whale is distributed worldwide in tropical to temperate waters (Leatherwood and Reeves 1983). Sightings of these animals in the northern Gulf of Mexico occur primarily on the continental slope (Mullin and Fulling 2004). Short-finned pilot whales were seen 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 Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock(s). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

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. From 1991 through 1994, line-transect vessel surveys were conducted during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ) (Hansen *et al.* 1995). Survey effort-weighted estimated average abundance of short-finned pilot whales for all surveys combined was 353 (CV=0.89) (Hansen *et al.* 1995). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.

Similar surveys were conducted during April/May from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico, using NOAA ships *Oregon II* (1996, 1997, 1999) and *Gordon Gunter* (2000, 2001). Estimates for all oceanic strata were summed, as survey effort was not uniformly distributed, to calculate a total estimate for the entire northern Gulf of Mexico oceanic waters (Figure 1; Mullin and Fulling 2004). Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate.

The estimate of abundance for short-finned pilot whales in oceanic waters, pooled from 1996 to 2001, is 2,388 (CV=0.48) (Mullin and Fulling 2004), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normal distributed abundance estimate. This is equivalent to the 20th percentile of the log-normal distributed abundance estimate as specified by Wade and Angliss (1997). The best estimate of abundance for short-finned pilot whales is 2,388 (CV=0.48). The minimum population estimate for the northern Gulf of Mexico is 1,628 short-finned pilot whales.

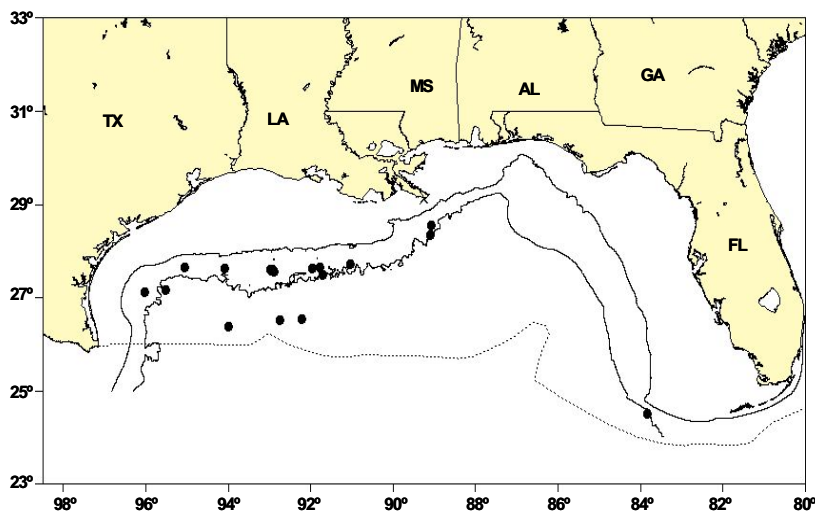


Figure 1. Distribution of short-finned pilot whale sightings from SEFSC spring vessel surveys during 1996-2001. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100 m and 1,000 m isobaths and the dotted line indicates the offshore extent of the U.S. EEZ.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 1996-2001 of 2,388 (CV=0.48) and that for 1991-1994 of 353 (CV=0.52) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low.

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 net productivity rate and a recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 1,628 (CV=0.48). 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 the stock is of unknown status. PBR for the northern Gulf of Mexico short-finned pilot whale is 16.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of short-finned pilot whales during 1998-2003 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004).

Fisheries Information

The level of past or current, direct, human-caused mortality of short-finned pilot whales in the northern Gulf of Mexico is unknown. Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the U.S. Gulf of Mexico. There were no recent reports of mortality or serious injury to short-finned pilot whales by this fishery. There was 1 logbook report of a fishery-related injury of a pilot whale in the northern Gulf of Mexico in 1991.

Other Mortality

There were 2 reported mass strandings of short-finned pilot whales in the Gulf of Mexico during 1999-2003. Both mass strandings occurred in Florida. Two animals mass stranded in May 1999, and 9 animals in October 2001. One of the 9 animals from 2001 displayed evidence of human interactions; for the remaining animals there was no evidence of human interactions. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in fishery interactions wash ashore, not all that wash ashore are discovered, reported or investigated, 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 interactions.

Table 1. Short-finned pilot whale (<i>Globicephala macrorhynchus</i>) strandings along the U.S. Gulf of Mexico coast, 1999-2003.						
State	1999	2000	2001	2002	2003	TOTAL
Alabama	0	0	0	0	0	0
Florida	2 ^a	0	9 ^b	0	0	11
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	0	0	0	0	0
Total	2	0	9	0	0	11
^a Florida mass stranding of 2 animals in May 1999						
^b Florida mass stranding of 9 animals in October 2001						

STATUS OF STOCK

The status of short-finned pilot whales in the northern Gulf of Mexico, relative to OSP, 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 fishery-related mortality and serious injury for this stock is unknown, but assumed to be less than 10% of the calculated PBR and can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because average annual fishery-related mortality and serious injury does not exceed PBR.

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