NORTH ATLANTIC RIGHT WHALE (*Eubalaena glacialis*): Western Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The western North Atlantic right whale population ranges primarily from calving grounds in coastal waters of the southeastern United States to feeding grounds in New England waters and the Canadian Bay of Fundy, Scotian Shelf, and Gulf of St. Lawrence. Knowlton *et al.* (1992) reported several long-distance movements as far north as Newfoundland, the Labrador Basin, and southeast of Greenland. In addition, recent resightings of photographically identified individuals have been made off Iceland, in the old Cape Farewell whaling ground east of Greenland (Hamilton *et al.* 2007), northern Norway (Jacobsen *et al.* 2004), and the Azores (Hamilton *et al.* 2009). The September 1999 Norwegian sighting represents one of only two published sightings this century of a right whale in Norwegian waters, and the first since 1926. Together, these long-range matches indicate an extended range for at least some individuals and perhaps the existence of important habitat areas not presently well described. The few published records from the Gulf of Mexico (Moore and Clark 1963; Schmidly *et al.* 1972) represent either distributional anomalies, normal wanderings of occasional animals, or a more extensive historic range beyond the sole known calving and wintering ground in the waters of the southeastern United States. Whatever the case, the location of much of the population is unknown during the winter. Offshore (greater than 30 miles) surveys flown off the coast of northeastern Florida and southeastern Georgia from 1996 to 2001 had 3 sightings in 1996, 1 in 1997, 13 in 1998, 6 in 1999, 11 in 2000 and 6 in 2001 (within each year, some were repeat sightings of previously recorded individuals). Several of the years that offshore surveys were flown were some of the lowest count years for calves and for numbers of right whales in the Southeast recorded since comprehensive surveys began in the calving grounds. Therefore, the frequency with which right whales occur in offshore waters in the southeastern U.S. remains unclear.

Research results suggest the existence of six major habitats or congregation areas for western North Atlantic right whales: the coastal waters of the southeastern United States; the Great South Channel; Georges Bank/Gulf of Maine; Cape Cod and Massachusetts Bays; the Bay of Fundy; and the Scotian Shelf. However, movements within and between habitats are extensive. In 2000, one whale was photographed in Florida waters on 12 January, then again eleven days later (23 January) in Cape Cod Bay, less than a month later off Georgia (16 February), and back in Cape Cod Bay on 23 March, effectively making the round-trip migration to the Southeast and back at least twice during the winter season (Brown and Marx 2000). Results from satellite tags clearly indicate that sightings separated by perhaps two weeks should not necessarily be assumed to indicate a stationary or resident animal. Instead, telemetry data have shown rather lengthy and somewhat distant excursions, including into deep water off the continental shelf (Mate *et al.* 1997; Baumgartner and Mate 2005). Systematic surveys conducted off the coast of North Carolina during the winters of 2001 and 2002 sighted 8 calves, suggesting the calving grounds may extend as far north as Cape Fear. Four of the calves were not sighted by surveys conducted further south. One of the cows photographed was new to researchers, having effectively eluded identification over the period of its maturation (McLellan *et al.* 2004). There is also at least one recent case of a calf apparently being born in the Gulf of Maine (Patrician *et al*. 2009).

New England waters are ~~an~~ important feeding habitats for right whales, which feed in this area primarily on copepods (largely of the genera *Calanus* and *Pseudocalanus*). Research suggests that right whales must locate and exploit extremely dense patches of zooplankton to feed efficiently (Mayo and Marx 1990). These dense zooplankton patches are likely a primary characteristic of the spring, summer, and fall right whale habitats (Kenney *et al.* 1986, 1995). While feeding in the coastal waters off Massachusetts has been better studied than in other areas, right whale feeding has also been observed on the margins of Georges Bank, in the Great South Channel, in the Gulf of Maine, in the Bay of Fundy, and over the Scotian Shelf. The characteristics of acceptable prey distribution in these areas are beginning to emerge (Baumgartner *et al.* 2003; Baumgartner and Mate 2003). NMFS (National Marine Fisheries Service) and Provincetown Center for Coastal Studies aerial surveys during springs of 1999-2006 found right whales along the Northern Edge of Georges Bank, in the Great South Channel, in Georges Basin, and in various locations in the Gulf of Maine including Cashes Ledge, Platts Bank, and Wilkinson Basin. Analysis of the sightings data has shown that utilization of these areas has a strong seasonal component (Pace and Merrick 2008). The consistency with which right whales occur in such locations is relatively high, but these studies also highlight the high interannual variability in right whale use of some habitats .(Pendleton, et al. 2009) .

Genetic analyses based upon direct sequencing of mitochondrial DNA (mtDNA) have identified six 7 mtDNA haplotypes in the western North Atlantic right whale, including hetroplasmy that led to the declaration of a the 7th haplotype (Malik *et al.* 1999, McLeod and White 2010). Schaeff *et al.* (1997) compared the genetic variability of North Atlantic and southern right whales (*E. australis*), and found the former to be significantly less diverse, a finding broadly replicated by Malik *et al.* (2000). The low diversity in North Atlantic right whales might be indicative of inbreeding, but no definitive conclusion can be reached using current data. Additional work comparing modern and historic genetic population structure, using DNA extracted from museum and archaeological specimens of baleen and bone, has suggested that the eastern and western North Atlantic populations were not genetically distinct (Rosenbaum *et al.* 1997; 2000). However, the virtual extirpation of the eastern stock and its lack of recovery in the last hundred years strongly suggests population subdivision over a protracted (but not evolutionary) timescale. Genetic studies concluded that the principal loss of genetic diversity occurred prior to the 18th century (Waldick *et al.* 2002). However, revised conclusions that nearly all the remains in the North American Basque whaling archaeological sites were bowhead whales and not right whales (Rastogi *et al.* 2004) contradict the previously held belief that Basque whaling during the 16th and 17th centuries was principally responsible for the loss of genetic diversity.

High-resolution (using 35 microsatellite loci) genetic profiling has been completed for 66% of all identified North Atlantic right whales through 2001. This work has improved our understanding of genetic variability, number of reproductively active individuals, reproductive fitness, parentage and relatedness of individuals (Frasier *et al.* 2007).

One emerging result of the genetic studies is the importance of obtaining biopsy samples from calves on the calving grounds. Only 60% of all known calves are seen with their mothers in summering areas, when their callosity patterns are stable enough to reliably make a photo-ID match later in life. The remaining 40% are not seen on a known summering ground. Because the calf's genetic profile is the only reliable way to establish parentage, if the calf is not sampled when associated with its mother early on, then it is not possible to link it with a calving event or to its mother, and information such as age and familial relationships is lost. From 1980 to 2001, there were 64 calves born that were not sighted later with their mothers and thus unavailable to provide age-specific mortality information (Frasier *et al.* 2007). An additional interpretation of paternity analyses is that the population size may be larger than was previously thought. Fathers for only 45% of known calves have been genetically determined. However, genetic profiles were available for 69% of all photo-identified males (Frasier 2005). The conclusion was that the majority of these calves must have different fathers that cannot be accounted for by the unsampled males and the population of males must be larger (Frasier 2005). This inference of additional animals that have never been captured photographically and/or genetically suggests the existence of habitats of potentially significant use that remain unknown. Since 2006, collaborators have sampled approximately 66–% of the calves detected in the wintering grounds.

POPULATION SIZE

The western North Atlantic minimum stock size is based on a census of individual whales identified using photo-identification techniques. A review of the photo-ID recapture database as it existed on 6 July 201021 October 2011 indicated that 396 425 individually recognized whales in the catalog were known to be alive during 20097. Whales catalogued by this date included 20 of the 39 calves born during that year. Thus adding the 189 calves not yet catalogued brings the minimum number alive in 1992009 to 444 (Figure 1). Thisis number represents a minimum population size. This count has no associated coefficient of variation.

Previous estimates using the same method with the added assumption that whales seen within the previous seven years were still alive have resulted in counts of 295 animals in 1992 (Knowlton *et al.* 1994) and 299 animals in 1998 (Kraus *et al.* 2001). An International Whaling Commission (IWC) workshop on status and trends of western North Atlantic right whales gave a minimum direct-count estimate of 263 right whales alive in 1996 and noted that the true population was unlikely to be substantially greater than this (Best *et al.* 2001).

Historical Abundance

An estimate of pre-exploitation population size is not available. Basque whalers were thought to have taken right whales during the 1500s in the Strait of Belle Isle region (Aguilar 1986), however, recent genetic analysis has shown that nearly all of the remains found in that area are, in fact, those of bowhead whales (Rastogi *et al.* 2004; Frasier *et al.* 2007). The stock of right whales may have already been substantially reduced by the time whaling was begun by colonists in the Plymouth area in the 1600s (Reeves *et al.* 2001; Reeves *et al.* 2007). A modest but persistent whaling effort along the coast of the eastern U.S. lasted three centuries, and the records include one report of 29 whales killed in Cape Cod Bay in a single day during January 1700. Based on incomplete historical whaling data, Reeves and Mitchell could conclude only that there were at least hundreds of right whales present in the western North Atlantic during the late 1600s. Reeves *et al.* (1992) plotted a series of population trajectories using historical data, assuming a present-day population size of 350 animals. The results suggested that there may have been at least 1,000 right whales in the population during the early to mid-1600s, with the greatest population decline occurring in the early 1700s. The authors cautioned, however, that the record of removals is incomplete, the results were preliminary, and refinements are required. Based on back calculations using the present population size and growth rate, the population may have numbered fewer than 100 individuals by 1935 when international protection for right whales came into effect (Hain 1975; Reeves *et al.* 1992; Kenney *et al.* 1995). However, little is known about the population dynamics of right whales in the intervening years.

Minimum Population Estimate

The western North Atlantic population size was estimated to be at least ~~396~~ 444 individuals in 2009~~7~~ based on a census of individual whales identified using photo-identification techniques. This value is a minimum and does not include animals that were alive prior to 2008~~7~~, but not recorded in the individual sightings database as seen during 1 December 2008~~4~~ to ~~06 July~~21 October 2011~~0~~ (note that matching of photos taken during 20~~0~~10~~8~~-2011~~0~~ was not complete at the time these data were received). ~~It also does not include some calves known to be born during 2007, or any other individual whale seen during 2007 but not yet entered into the catalog.~~

Current Population Trend

The population growth rate reported for the period 1986-1992 by Knowlton *et al.* (1994) was 2.5% (CV=0.12), suggesting that the stock was showing signs of slow recovery, but that number may have been influenced by discovery phenomenon as existing whales were recruited to the catalog. ~~However, w~~Work by Caswell *et al.* (1999) suggested that crude survival probability declined from about 0.99 in the early 1980s to about 0.94 in the late 1990s. The decline was statistically significant. Additional work conducted in 1999 was reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop concluded based on several analytical approaches that survival had indeed declined in the 1990s. Although capture heterogeneity could negatively bias survival estimates, the workshop concluded that this factor could not account for the entire observed decline, which appeared to be particularly marked in adult females. Another workshop was convened by NMFS in September 2002, and reached similar conclusions regarding the decline in the population (Clapham 2002). At the time, no one examined the early part of the recapture series for excessive retrospective recaptures which had the potential to positively bias survival as the catalog was being developed.

An increase in mortality in 2004 and 2005 was cause for serious concern (Kraus *et al.* 2005). Calculations based on demographic data through 1999 (Fujiwara and Caswell 2001) indicated that this mortality rate increase would reduce population growth by approximately 10% per year (Kraus *et al.* 2005). Of those mortalities, six were adult females, three of which were carrying near-term fetuses. Furthermore, four of these females were just starting to bear calves, losing their complete lifetime reproduction potential. ~~While s~~Strong evidence for flat or negative growth exists in the time series of minimum number alive during 1998-2000, which coincided with very low calf production, 2004 and 2005 appear to show good growth (Figure 1).

~~Despite the preceding, e~~Examination of the minimum number alive population index calculated from the individual sightings database, as it existed on ~~6 July~~21 October 2011~~06~~, for the years 1990-2009~~7~~ (Figure 1) suggests a positive and slowly accelerating trend in population size. These data reveal a significant increase in the number of catalogued whales ~~alive during this period, but with significant variation due to apparent losses exceeding gains during 1998-99.~~ with a geometric m~~M~~ean growth rate for the period of~~was~~ 2.6~~4~~%.

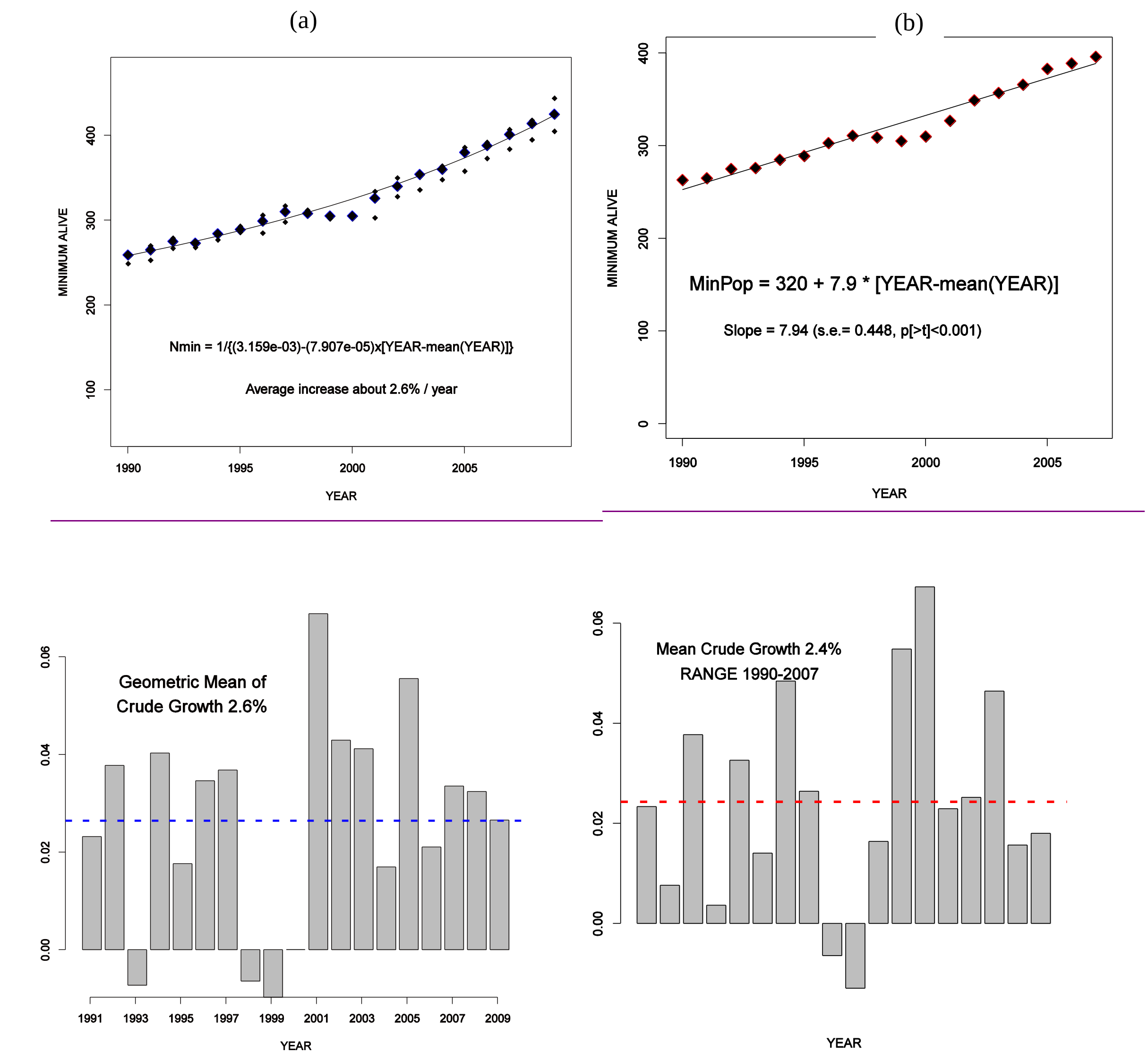

Figure 1. Minimum number alive (a) and crude annual growth rate (b) for cataloged North Atlantic right whales. Minimum number (N) of cataloged individuals known to be alive in any given year includes all whales known to be alive prior to that year and seen in that year or subsequently plus all whales newly cataloged that year. ~~It does not include calves born that year or any other individuals not yet c~~Cataloged whales may include some but not all calves produced each year. Bracketing the minimum number of cataloged whales is the number without calves (below) and that plus calves above, the latter which yields Nmin for purposes of s~~ot~~tock assessment. Mean crude growth rate (dashed line) is the exponentiated mean of $\log_e [(N_{t+1}-N_t)/N_t]$ *for each year (t).*

The minimum number alive may increase slightly in later years as analysis of the backlog of unmatched but high-quality photographs proceeds. For example, the minimum number alive for 2002 was calculated to be 313 from a 15 June 2006 data set and revised to 325 using the 30 May 2007 data set.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

During 1980-1992, 145 calves were born to 65 identified cows. The number of calves born annually ranged from 5 to 17, with a mean of 11.2 (SE=0.90). The reproductively active female pool was static at approximately 51 individuals during 1987-1992. Mean calving interval, based on 86 records, was 3.67 years. There was an indication that calving intervals may have been increasing over time, although the trend was not statistically significant (P=0.083) (Knowlton *et al.* 1994).

Total reported calf production and calf mortalities from 1993 to 2009 are shown below in Table 1. The mean calf production for this seventeen year period was 17.2 (15.3-19.4; 95% C.I.). During the 2004 and 2005 calving seasons three adult females were found dead with near-term fetuses.

An updated analysis of calving intervals through the 1997/1998 season suggests that the mean calving interval increased since 1992 from 3.67 years to more than 5 years, a significant trend (Kraus *et al.* 2001). This conclusion was supported by modeling work reviewed by the IWC workshop on status and trends in this population (Best *et al.* 2001); the workshop agreed that calving intervals had indeed increased and further that the reproductive rate was approximately half that reported from studied populations of southern right whales, *E. australis*. A workshop on possible causes of reproductive failure was held in April 2000 (Reeves *et al.* 2001). Factors considered included contaminants, biotoxins, nutrition/food limitation, disease, and inbreeding problems. While no conclusions were reached, a research plan to further investigate this topic was developed. Analyses completed since that workshop found that in the most recent years, calving intervals were closer to 3 years (Kraus *et al.* 2007).

An analysis of the age structure of this population suggests that it contains a smaller proportion of juvenile whales than expected (Hamilton *et al.* 1998; Best *et al.* 2001), which may reflect lowered recruitment and/or high juvenile mortality. Calf and perinatal mortality was estimated by Browning *et al.* (2010) to be between 17 and 45 animals during the period 1989 and 2003. In addition, it is possible that the apparently low reproductive rate is due in part to an unstable age structure or to reproductive senescence on the part of some females. However, few data are available on either factor and senescence has not been documented for any baleen whale.

The maximum net productivity rate is 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).

Table 1. North Atlantic right whale calf production and mortality, 1993-~~2009~~2010.

Year[a]	Reported calf production	Reported calf mortalities
1993	8	2
1994	9	0
1995	7	0
1996	22	3
1997	20	1
1998	6	1
1999	4	0
2000	1	0
2001	31	4
2002	21	2
2003	19	0
2004	17	1
2005	28	0
2006	19	2
2007	23	2
2008	23	2
2009	39	1
2010	19	0

a. includes December of the previous year

POTENTIAL BIOLOGICAL REMOVAL

Potential biological removal (PBR) is the product of minimum population size, one-half the maximum net productivity rate and a ~~"recovery"~~recovery factor for endangered, depleted, threatened stocks, or stocks of unknown status relative to OSP (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The recovery factor for right whales is 0.10 because this species is listed as endangered under the Endangered Species Act (ESA). The minimum population size is 444~~396~~. The maximum productivity rate is 0.04, the default value for cetaceans. ~~and the observed maximum net productivity is 0.0264. Half of the observed net productivity is 0.0132, thus~~ PBR for the Western Atlantic stock of the North Atlantic ~~Right~~ right whale is 0.~~57~~9.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period ~~2005~~ 2006 through ~~2009~~2010, the minimum rate of annual human-caused mortality and serious injury to right whales averaged ~~2.6~~3.0 per year (U.S. waters, ~~1.6~~2.~~2~~4; Canadian waters, ~~1.0~~0.6). This is derived from two components: 1) incidental fishery entanglement records at ~~1.0~~1.8 per year (U.S. waters, 1.~~0~~6; Canadian waters, 0.2), and 2) ship strike records at ~~1.6~~1.2 per year (U.S. waters, ~~1.2~~0.8; Canadian waters, 0.4). Of the 8 reported fisheries entanglements from U. S. waters during this 5-year time period, 5 were reported before the Atlantic Large Whale Take Reduction Plan's sinking-groundline rule went into effect in April 2009, and 3 were reported after enactment of the rule. Of the 4 reported ship strike serious injury and mortalities from U.S. waters during this 5-year time period, 3 were in 2006 (prior to the speed limit rule which went into effect in December 2009), and 1 was in 2010, after the rule was in effect. Statistical analysis of the effectiveness of both of these rules is underway. Beginning with the 2001 Stock Assessment Report, Canadian records were incorporated into the mortality and serious injury rates of this report to reflect the effective range of this stock. It is also important to stress that serious injury determinations are made based upon the best available information; these determinations may change with the availability of new information (Cole *et al.* 2005). For the purposes of this report, discussion is primarily limited to those records considered confirmed human-caused mortalities or serious injuries. For more information on determinations for this period, see Henry *et al.* (~~2011~~2012). Annual rates calculated from detected mortalities should not be considered an unbiased estimate of human-caused mortality, but they represent a definitive lower bound. Detections are haphazard, incomplete and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

Background

The details of a particular mortality or serious injury record often require a degree of interpretation. The assigned cause is based on the best judgment of the available data; additional information may result in revisions. When reviewing Table 2 below, several factors should be considered: 1) a ship strike or entanglement may occur at some distance from the reported location; 2) the mortality or injury may involve multiple factors; for example, whales that have been both ship struck and entangled are not uncommon; 3) the actual vessel or gear type/source is often uncertain; and 4) in entanglements, several types of gear may be involved.

The serious injury determinations are susceptible to revision. There are several records where a struck and injured whale was re-sighted later, apparently healthy, or where an entangled or partially disentangled whale was re-sighted later free of gear. The reverse may also be true: a whale initially appearing in good condition after being struck or entangled is later re-sighted and found to have been seriously injured by the event. Entanglements of juvenile whales are typically considered serious injuries because the constriction on the animal is likely to become increasingly lethal as the whale grows (Cole *et al.* 2005; Nelson *et al.* 2007).

A serious injury was defined in 50 CFR part 229.2 as an injury that is likely to lead to mortality. We therefore limited the serious injury designation to only those reports that had substantiated evidence that the injury, whether from entanglement or vessel collision, was likely to lead to the whale's death (Cole *et al.* 2005; ~~Nelson *et al.* 2007; Glass *et al.* 2008; Glass *et al.* 2010;~~ Henry *et al.* ~~2011~~2012). Determinations of serious injury were made on a case-by-case basis following recommendations from the workshop conducted in 1997 on differentiating serious and non-serious injuries (Angliss and DeMaster 1998). Injuries that impeded a whale's locomotion or feeding were not considered serious injuries unless they were likely to be fatal in the foreseeable future. There was no forecasting of how the entanglement or injury may increase the whale's susceptibility to further injury, namely from additional entanglements or vessel collisions. This conservative approach likely underestimates serious injury rates.

With these caveats, the total minimum detected annual average human-induced mortality and serious injury incurred by this stock (including fishery and non-fishery related causes) for the period 2006-2010~~is~~ was ~~2.6~~ 3.0 right whales per year (U.S. waters ~~1.6~~2.4; Canadian waters, ~~1.0~~0.6). As with entanglements, some injury or mortality due to ship strikes is almost certainly undetected, particularly in offshore waters. Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or necropsied) represent lost data, some of which may relate to human impacts. For these reasons, the estimate of ~~2.6~~3.0 right whales per year must be regarded as ~~derived from~~a minimum count (Henry *et al.* ~~2011~~2012).

Further, the small population size and low annual reproductive rate of right whales suggest that human sources of mortality may have a greater effect relative to population growth rates than for other whales. The principal factors believed to be retarding growth and recovery of the population are ship strikes and entanglement with fishing gear. Between 1970 and 1999, a total of 45 right whale mortalities was recorded (IWC ~~[International Whaling Commission]~~ 1999; Knowlton and Kraus 2001; Glass *et al.* 2009). Of these, 13 (28.9%) were neonates that were believed to have died from perinatal complications or other natural causes. Of the remainder, 16 (35.6%) resulted from ship strikes, 3 (6.7%) were related to entanglement in fishing gear (in two cases lobster gear, and one gillnet gear), and 13 (28.9%) were of unknown cause. At a minimum, therefore, 42.2% of the observed total for the period and 50% of the 32 non-calf deaths were attributable to human impacts (calves accounted for three deaths from ship strikes). Young animals, ages 0-4 years, are apparently the most impacted portion of the population (Kraus 1990).

Finally, entanglement or minor vessel collisions may not kill an animal directly, but may weaken or otherwise affect it so that it is more likely to become vulnerable to further injury. Such was apparently the case with the two-year-old right whale killed by a ship off Amelia Island, Florida in March 1991 after having carried gillnet gear wrapped around its tail region since the previous summer (Kenney and Kraus 1993). A similar fate befell right whale #2220, found dead on Cape Cod in 1996.

Fishery-Related Serious Injury and Mortality

Reports of mortality and serious injury relative to PBR as well as total human impacts are contained in records maintained by the New England Aquarium and the NMFS Northeast and Southeast Regional Offices (Table 2). From ~~2005~~ 2006 through ~~2009~~2010, ~~5~~ 8 of ~~13~~ 15 records of mortality or serious injury (including records from both U.S.~~A~~ and Canadian waters) involved entanglement or fishery interactions. For this time frame, the average reported mortality and serious injury to right whales due to fishery entanglement was ~~1.0~~1.68 whales per year (U.S. waters, ~~1.0~~1.6; Canadian waters, ~~0~~0.2). Information from an entanglement event often does not include the detail necessary to assign the entanglements to a particular fishery or location.

Although disentanglement is ~~either~~ often unsuccessful or not possible for ~~the majority of~~many cases, during the period ~~2005~~ 2006 through ~~2009~~2010, there were at least ~~three~~ two documented cases of entanglements for which the intervention of disentanglement teams averted a likely serious-injury determination. ~~On 3 December 2005, #3445 – the 2004 calf of #2145 – was first sighted off Brunswick, Georgia, with line across its back and around its right flipper. Over 300 feet of trailing line was removed. This whale was resighted on 12 June 2006, apparently gear-free.~~ An adult female, #2029, first sighted entangled in the Great South Channel on 9 March 2007, may have avoided serious injury due to being partially disentangled on 18 September 2007 by researchers in the Bay of Fundy, Canada. On 8 December 2008, #3294 was successfully disentangled. Sometimes, even with disentanglement, an animal may die of injuries sustained from fishing gear. A female yearling right whale, #3107 was first sighted with gear wrapping its caudal peduncle on 6 July 2002 near Briar Island, Nova Scotia. Although the gear was removed on 1 September by the New England Aquarium disentanglement team, and the animal seen alive on an aerial survey on 1 October, its carcass washed ashore at Nantucket on 12 October, 2002 with deep entanglement injuries on the caudal peduncle. Additionally, but infrequently, a whale listed as seriously injur~~y~~ed becomes gear-free without a disentanglement effort and is seen later in reasonable health. Such was the case for whale #1980, listed as a serious injury in 2008 but seen gear-free and apparently healthy in 2011.

In January 1997, NMFS changed the classification of the Gulf of Maine and U.S. mid-Atlantic lobster pot fisheries from Category III to Category I based on examination of stranding and entanglement records of large whales from 1990 to 1994 (62 FR 33, Jan. 2, 1997).

The only bycatch of a right whale observed by the Northeast Fisheries Observer Program was in the pelagic drift gillnet fishery in 1993. No mortalities or serious injuries have been documented in any of the other fisheries monitored by NMFS.

Entanglement records from 1990 through ~~2009~~ 2010 maintained by NMFS Northeast Regional Office (NMFS, unpublished data) included ~~68~~ 74 confirmed right whale entanglements, including right whales in weirs, gillnets, and trailing line and buoys. Because whales often free themselves of gear following an entanglement event, scarring may be a better indicator of fisheries interaction than entanglement records. In an analysis of the scarification of right whales, 338 of 447 (75.6%) whales examined during 1980-2002 were scarred at least once by fishing gear

(Knowlton *et al.* 2005). Further research using the North Atlantic Right Whale Catalogue has indicated that, annually, between 14% and 51% of right whales are involved in entanglements (Knowlton *et al.* 2005). Incidents of entanglements in groundfish gillnet gear, cod traps, and herring weirs in waters of Atlantic Canada and the U.S. east coast were summarized by Read (1994). In six records of right whales that were entangled in groundfish gillnet gear in the Bay of Fundy and Gulf of Maine between 1975 and 1990, the whales were either released or escaped on their own, although several whales were observed carrying net or line fragments. A right whale mother and calf were released alive from a herring weir in the Bay of Fundy in 1976.

For all areas, specific details of right whale entanglement in fishing gear are often lacking. When direct or indirect mortality occurs, some carcasses come ashore and are subsequently examined, or are reported as "floaters" at sea. The number of unreported and unexamined carcasses is unknown, but may be significant in the case of floaters. More information is needed about fisheries interactions and where they occur.

Other Mortality

Ship strikes are a major cause of mortality and injury to right whales (Kraus 1990; Knowlton and Kraus 2001). Records from ~~2005~~ 2006 through ~~2009~~ 2010 have been summarized in Table 2. For this time frame, the average reported mortality and serious injury to right whales due to ship strikes was 1.~~6~~2 whales per year (U.S. waters, ~~1.2~~0.8; Canadian waters, 0.4).

~~Table 2. Confirmed human-caused mortality and serious injury records of North Atlantic right whales, January 2005 through December 2009.~~

Date[a]	Report Type[b]	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh inter	
1/12/2005	mortality	Adult Female #2143 13.1m	Cumberland Island, GA	P	-	Healed propeller wounds from strike as a calf reopened as a result of pregnancy
3/10/2005	serious injury	Adult[b] Female[b] #2425	Cumberland Island, GA	P	-	43 ft power yacht partially severed left fluke; resighted 9/4/05 in extremely poor condition, not seen since
4/28/2005	mortality	Adult Female #2617 14.7m	Monomoy Island, MA	P	-	Significant bruising and multiple vertebral fractures
1/10/2006	mortality	Calf Male 5.4m w/out fluke	Jacksonville, FL	P	-	Propeller lacerations associated with hemorrhaging and edema; flukes completely severed
1/22/2006	mortality	Calf Female[b] 5.6m	off Ponte Vedra Beach, FL	-	P	Significant premortem lesions from entanglement in apparent monofilament netting; no gear present

3/11/2006	serious injury	Yearling Male #3522	Off Cumberland Island, GA	P	-	11 propeller lacerations across dorsal surface; not sighted since
7/24/2006	mortality	age unknown Female 9.6m	Campobello Island, NB	P	-	Propeller lacerations through blubber, into muscle and ribs
8/24/2006	mortality	Adult Female 14.7m	Roseway Basin, NS	P	-	16 fractured vertebrae; dorsal blubber bruise from head to genital region
12/30/2006	mortality	Yearling Male #3508 12.6m	off Brunswick, GA	P	-	20 propeller lacerations along right side of head and back with associated hemorrhaging
3/31/2007	mortality	Calf Male 7.7m	Outer Banks, NC	-	P	Edema associated with flipper and dorsal & ventral thoracic musculature; epidermal abrasion indicated entangling body and flipper wraps; no gear recovered
2/3/2008	serious injury	Adult Male #1980	Cape Hatteras, NC	-	P	Embedded wrap in rostrum; decline in health; no gear recovered
1/14/2009	serious injury	Juvenile sex unknown #3311	off Brunswick, GA	-	P	Partial disentanglement 03/06/2008; not seen since; embedded wrap in rostrum & lip removed; decline in health; gear analysis pending
1/27/2009	serious injury	Juvenile Male #3710 9.8m	Cape Lookout Shoals, NC	-	P	Live stranded w/ spinal scoliosis; euthanized; necropsy determined scoliosis due to entanglement and not congenital; entanglement wounds chronically infected; no gear recovered

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

b. Additional information which was not included in previous reports.

Table 2. Confirmed human-caused mortality and serious injury records of Western North Atlantic right whales (Eubalaena glacialis), 2006 - 2010.

Date[a]	Report Type	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship Strike	Entanglement/ Fishery interaction	

1/10/06	mortality	Calf Male 5.4m w/out fluke	Jacksonville, FL	P	-	Propeller lacerations associated with hemorrhaging and edema; flukes completely severed
1/22/06	mortality	Calf Female[b] 5.6m	off Ponte Vedra Beach, FL	-	P	Significant premortem lesions from entanglement in apparent monofilament netting; no gear present
3/11/06	serious injury	Yearling Male #3522	Off Cumberland Island, GA	P	-	11 propeller lacerations across dorsal surface
7/24/06	mortality	age unknown Female 9.6m	Campobello Island, NB	P	-	Propeller lacerations through blubber, into muscle and ribs
8/24/06	mortality	Adult Female 14.7m	Roseway Basin, NS	P	-	16 fractured vertebrae; dorsal blubber bruise from head to genital region
12/30/06	mortality	Yearling Male #3508 12.6m	off Brunswick, GA	P	-	20 propeller lacerations along right side of head and back with associated hemorrhaging
3/31/07	mortality	Calf Male 7.7m	Outer Banks, NC	-	P	Edema associated with flipper and dorsal & ventral thoracic musculature; epidermal abrasion indicated entangling body and flipper wraps; no gear recovered
9/24/08[c]	serious injury	Adult Male #2110	Jeffreys Ledge	S	P	Spinal scoliosis associated with fresh entanglement injuries; compromised pectorals; emaciated; heavy cyamid load; pale skin; healed lacerations from previously documented vessel strike injury potentially exacerbate scoliosis; no gear present

1/14/09	serious injury	Juvenile sex unknown #3311	off Brunswick, GA	_	P	Partial disentanglement; embedded wrap in rostrum & lip removed; decline in health; fixed trap/pot gear
1/27/09	serious injury	Juvenile Male #3710 9.8m	Cape Lookout Shoals, NC	_	P	Live stranded w/ spinal scoliosis; euthanized; necropsy determined scoliosis due to entanglement and not congenital; entanglement wounds chronically infected; no gear recovered
6/27/10	mortality	Adult Male	off Cape May, NJ	_	P	Evidence of constricting rostrum, mouth & flipper wraps w/ associated hemorrhage and bone damage; no gear recovered
7/2/10	mortality	Calf Male 7.9m	off Grand Manan Island, ME	P	_	2 large lacerations from dorsal to ventral surface
8/12/10	mortality	Adult Male 14.1m	Digby Neck, NS	_	P	Evidence of entanglement with associated hemorrhaging around right flipper; no gear present
9/10/10	serious injury	Adult Female #1503	Jeffreys Ledge	_	p	Constricting rostrum wrap; evidence of health decline; no gear recovered
12/25/10	serious injury	Juvenile Female #3911	off Jacksonville, FL	_	p	Embedded line in mouth and on flipper; severe health decline; acute cause of death was shark predation; gear analysis pending

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.
b. Additional information on previous event that was not included in previous reports.
c. Additional even not included in previous reports.

STATUS OF STOCK

The size of this stock is considered to be extremely low relative to OSP in the U.S. Atlantic EEZ, and this species is listed as endangered under the ESA. The North Atlantic right whale is considered one of the most critically endangered populations of large whales in the world (Clapham *et al.* 1999). A Recovery Plan has been published for the North Atlantic right whale and is in effect (NMFS ~~[National Marine Fisheries Service]~~ 2005). NMFS is presently engaged in evaluating the need for critical habitat designation for the North Atlantic right whale. Under a prior listing as northern right whale, three critical habitats, Cape Cod Bay/Massachusetts Bay, Great South Channel, and the Southeastern U.S., were designated by NMFS (59 FR 28793, June 3, 1994). Two additional critical habitat areas in Canadian waters, Grand Manan Basin and Roseway Basin, were identified in Canada's final recovery strategy for the North Atlantic right whale (Brown *et al.* 2009). A National Marine Fisheries Service ESA status review in 1996 concluded that the western North Atlantic population remains endangered. This conclusion was reinforced by the International Whaling Commission (Best *et al.* 2001), which expressed grave concern regarding the status of this stock. Relative to populations of southern right whales, there are also concerns about growth rate, percentage of reproductive females, and calving intervals in this population. The total level of human-caused mortality and serious injury is unknown, but reported human-caused mortality and serious injury was a minimum of ~~2.6~~3.0 right whales per year from ~~2005~~ 2006 through ~~2009~~2010. Given that PBR has been set to 0.~~5~~79, no mortality or serious injury for this stock can be considered insignificant. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and also because the North Atlantic right whale is an endangered species.

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HUMPBACK WHALE (*Megaptera novaeangliae*): Gulf of Maine Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

In the western North Atlantic, humpback whales feed during spring, summer and fall over a geographic range encompassing the eastern coast of the United States (including the Gulf of Maine), the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Katona and Beard 1990). Other North Atlantic feeding grounds occur off Iceland and northern Norway, including off Bear Island and Jan Mayen (Christensen *et al.* 1992; Palsbøll *et al.* 1997). These six regions represent relatively discrete subpopulations, fidelity to which is determined matrilineally (Clapham and Mayo 1987). Genetic analysis of mitochondrial DNA (mtDNA) has indicated that this fidelity has persisted over an evolutionary timescale in at least the Icelandic and Norwegian feeding grounds (Palsbøll *et al.* 1995; Larsen *et al.* 1996). Previously, the North Atlantic humpback whale population was treated as a single stock for management purposes (Waring *et al.* 1999). Indeed, earlier genetic analyses (Palsbøll *et al.* 1995), based upon relatively small sample sizes, had failed to discriminate among the four western North Atlantic feeding areas. However, genetic analyses often reflect a timescale of thousands of years, well beyond those commonly used by managers. Accordingly, the decision was made to reclassify the Gulf of Maine as a separate feeding stock (Waring *et al.* 2000); this was based upon the strong fidelity by individual whales to this region, and the attendant assumption that, were this subpopulation wiped out, repopulation by immigration from adjacent areas would not occur on any reasonable management timescale. This reclassification has subsequently been supported by new genetic analyses based upon a much larger collection of samples than those utilized by Palsbøll *et al.* (1995). These analyses have found significant differences in mtDNA haplotype frequencies among whales sampled in four western feeding areas, including the Gulf of Maine (Palsbøll *et al.* 2001). During the 2002 Comprehensive Assessment of North Atlantic humpback whales, the International Whaling Commission acknowledged the evidence for treating the Gulf of Maine as a separate management unit (IWC 2002).

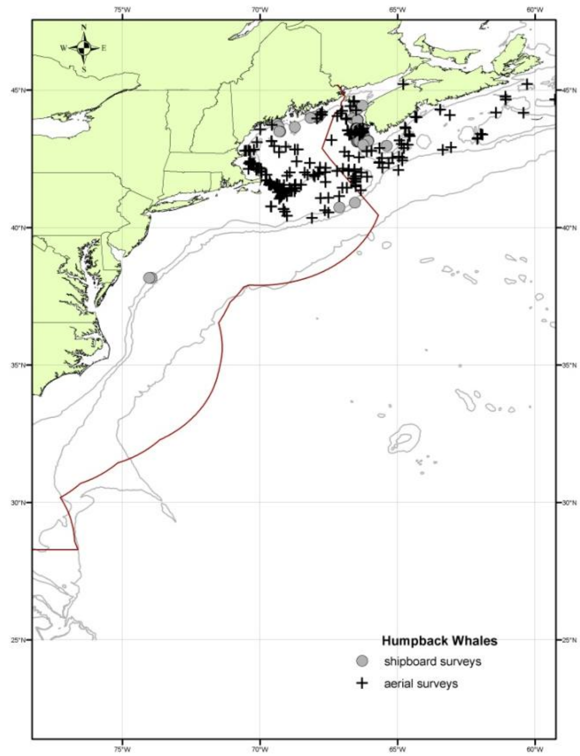

Figure 1. *Distribution of humpback whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, ~~and~~ 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

During the summers of 1998 and 1999, the Northeast Fisheries Science Center conducted surveys for humpback whales on the Scotian Shelf to establish the occurrence and population identity of the animals found in this region, which lies between the well-studied populations of the Gulf of Maine and Newfoundland. Photographs from both surveys were~~have now been~~ compared to both the overall North Atlantic Humpback Whale Catalogue and a large regional catalogue from the Gulf of Maine (maintained by the College of the Atlantic and the Provincetown Center for Coastal Studies, respectively); this work is summarized in Clapham *et al.* (2003). The match rate between the Scotian Shelf and the Gulf of Maine was 27% (14 of 52 Scotian Shelf individuals from both years). Comparable rates of exchange were obtained from the southern (28%, n=10 of 36 whales) and northern (27%, *n*=4 of 15 whales) ends of the Scotian Shelf, despite the additional distance of nearly 100 nautical miles (one whale was observed in both areas). In contrast, all of the 36 humpback whales identified by the same NMFS surveys elsewhere in the Gulf of Maine (including Georges Bank, southwestern Nova Scotia and the Bay of Fundy) had been previously observed in the Gulf of Maine region. The sighting histories of the 14 Scotian Shelf whales matched to the Gulf of Maine suggested that many of them were transient through the latter area. There were no matches between the Scotian Shelf and any other North Atlantic feeding ground, except the Gulf of Maine; however, instructive comparisons are compromised by the often low sampling effort in other regions in recent years. Overall, it appears that the northern range of many members of the Gulf of Maine stock does not extend onto the Scotian Shelf.

During winter, whales from most North Atlantic feeding areas (including the Gulf of Maine) mate and calve in the West Indies, where spatial and genetic mixing among feeding groups occurs (Katona and Beard 1990; Clapham *et al.* 1993; Palsbøll *et al.* 1997; Stevick *et al.* 1998). A few whales likely using eastern North Atlantic feeding areas migrate to the Cape Verde Islands (Reiner *et al.* 1996; Wenzel et al. 2009). In the West Indies, the majority of whales are found in the waters of the Dominican Republic, notably on Silver Bank and Navidad Bank, and in Samana Bay (Balcomb and Nichols 1982; Whitehead and Moore 1982; Mattila *et al.* 1989; Mattila *et al.* 1994). Humpback whales are also found at much lower densities throughout the remainder of the Antillean arc, from Puerto Rico to the coast of Venezuela (Winn *et al.* 1975; Levenson and Leapley 1978; Price 1985; Mattila and Clapham 1989).

Not all whales migrate to the West Indies every winter, and significant numbers of animals may be~~are~~ found in mid- and high-latitude regions at this time (Clapham *et al.* 1993; Swingle *et al.* 1993). An increased number of sightings of humpback whales in the vicinity of the Chesapeake and Delaware Bays occurred in 1992 (Swingle *et al.* 1993). Wiley *et al.* (1995) reported that 38 humpback whale strandings occurred during 1985-1992 in the U.S. mid-Atlantic and southeastern states. Humpback whale strandings increased, particularly along the Virginia and North Carolina coasts, and most stranded animals were sexually immature; in addition, the small size of many of these whales strongly suggested that they had only recently separated from their mothers. Wiley *et al.* (1995) concluded that these areas were becoming an increasingly important habitat for juvenile humpback whales and that anthropogenic factors may negatively impact whales in this area. There have also been a number of wintertime humpback sightings in coastal waters of the southeastern U.S. (NMFS unpublished data; New England Aquarium unpublished data). Whether the increased numbers of sightings represent a distributional change, or are simply due to an increase in sighting effort and/or whale abundance, is unknown.

A key question with regard to humpback whales off the southeastern and mid-Atlantic states is their population identity. This topic was investigated using fluke photographs of living and dead whales observed in the region (Barco *et al.* 2002). In this study, photographs of 40 whales (alive or dead) were of sufficient quality to be compared to catalogs from the Gulf of Maine (i.e., the closest feeding ground) and other areas in the North Atlantic. Of 21 live whales, 9 (43%) matched to the Gulf of Maine, 4 (19%) to Newfoundland and 1 (4.8%) to the Gulf of St Lawrence. Of 19 dead humpbacks, 6 (31.6%) were known Gulf of Maine whales. Although the population composition of the mid-Atlantic is apparently dominated by Gulf of Maine whales, lack of recent photographic effort in Newfoundland makes it likely that the observed match rates under-represent the true presence of Canadian whales in the region. Barco *et al.* (2002) suggested that the mid-Atlantic region primarily represents a supplemental winter feeding ground used by humpbacks.

In New England waters, feeding is the principal activity of humpback whales, and their distribution in this region has been largely correlated to abundance of prey species, although behavior and bottom topography are factors influencing foraging strategy (Payne *et al.* 1986, 1990). Humpback whales are frequently piscivorous when in New England waters, feeding on herring (*Clupea harengus*), sand lance (*Ammodytes* spp.), and other small fishes. In the northern Gulf of Maine, euphausiids are also frequently taken (Paquet *et al.* 1997). Commercial depletion of herring and mackerel led to an increase in sand lance in the southwestern Gulf of Maine in the mid-1970s, with a concurrent decrease in humpback whale abundance in the northern Gulf of Maine. Humpback whales were densest over the sandy shoals in the southwestern Gulf of Maine favored by the sand lance during much of the late 1970s and early 1980s, and humpback distribution appeared to have shifted to this area (Payne *et al.* 1986). An apparent reversal began in the mid-1980s, and herring and mackerel increased as sand lance again decreased (Fogarty *et al.* 1991). Humpback whale abundance in the northern Gulf of Maine increased markedly during 1992-1993, along with a major influx of herring (P. Stevick, pers. comm.). Humpback whales were few in nearshore Massachusetts waters in the 1992-1993 summer seasons. They were more abundant in the offshore waters of Cultivator Shoal and on the Northeast Peak on Georges Bank and on Jeffreys Ledge; these latter areas are traditional locations of herring occurrence. In 1996 and 1997, sand lance and therefore humpback whales were once again abundant in the Stellwagen Bank area. However, unlike previous cycles, when an increase in sand lance corresponded to a decrease in herring, herring remained relatively abundant in the northern Gulf of Maine, and humpbacks correspondingly continued to occupy this portion of the habitat, where they also fed on euphausiids (Wienrich et al. 1997). Diel patterns in humpback foraging behavior have been shown to correlate with diel patterns in sand lance behavior (Friedlaender *et al.* 2009).

In early 1992, a major research program known as the Years of the North Atlantic Humpback (YONAH) (Smith *et al.* 1999) was initiated. This was a large-scale, intensive study of humpback whales throughout almost their entire North Atlantic range, from the West Indies to the Arctic. During two primary years of field work, photographs for individual identification and biopsy samples for genetic analysis were collected from summer feeding areas and from the breeding grounds in the West Indies. Additional samples were collected from certain areas in other years. Results pertaining to the estimation of abundance and to genetic population structure are summarized below.

POPULATION SIZE

North Atlantic Population

The overall North Atlantic population (including the Gulf of Maine), derived from genetic tagging data collected by the YONAH project on the breeding grounds, was estimated to be 4,894 males (95% CI=3,374-7,123) and 2,804 females (95% CI=1,776-4,463) (Palsbøll *et al.* 1997). Because the sex ratio in this population is known to be even (Palsbøll *et al.* 1997), the excess of males is presumed a result of sampling bias, lower rates of migration among females, or sex-specific habitat partitioning in the West Indies; whatever the reason, the combined total is an underestimate of overall population size. Photographic mark-recapture analyses from the YONAH project provided an ocean-basin-wide estimate of 11,570 animals during 1992/1993 (CV=0.068, Stevick *et al.* 2003), and an additional genotype-based analysis yielded a similar but less precise estimate of 10,400 whales (CV=0.138, 95% CI=8,000 to 13,600) (Smith *et al.* 1999). In the northeastern North Atlantic, Øien (2001) estimated from sighting survey data that there were 889 (CV=0.32) humpback whales in the Barents and Norwegian Seas region.

As part of a large-scale assessment called More of North Atlantic Humpbacks (MoNAH) project, extensive sampling was conducted on humpbacks in the Gulf of Maine/Scotian Shelf region and the primary wintering ground on Silver Bank during 2004-2005. These data are being analyzed along with additional data from the Gulf of Maine to estimate abundance and refine knowledge of the North Atlantic humpback whales' population structure. The work is intended to update the YONAH population assessment.

Gulf of Maine stock - earlier estimates

Please see Appendix IV for earlier estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.~~if abundance estimates are older than eight years PBR is cannot be determined undetermined.~~

Gulf of Maine Stock - Recent surveys and abundance estimates

An abundance estimate of 359 (CV=0.75) humpback whales was obtained from a line-transect sighting survey conducted from 12 June to 4 August 2004 by a ship and plane.~~–~~ The 2004 survey covered a small portion of the habitat (6,180 km of trackline), from the 100-m depth contour on the southern Georges Bank to the lower Bay of Fundy; while the Scotian Shelf south of Nova Scotia was not surveyed.

An abundance estimate of 847 animals (CV=0.55) was derived from a line-transect sighting survey conducted during August 2006, which covered 10,676 km of trackline from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the Gulf of St. Lawrence~~.~~ (Table 1; Palka pers. comm.). ~~Some~~ Photo-identification evidence indicates ~~evidence exists to support~~ a 25% exchange rate between whales on the Scotian S~~s~~helf and the catalogued ~~animals and those in the~~ Gulf of Maine population (Clapham *et al.* 2003), which suggest that a 25% correction factor should be applied to the humpback population estimate from the Scotian Shelf stratum. Because the Scotian Shelf was surveyed ~~in only~~during 2006, the 25% correction factor ~~–~~was applied to only the 2006 abundance estimate. ~~By comparison~~In ~~stark~~ contrast to 2006, a ~~fully-corrected~~ line-transect based abundance estimate for humpbacks on the Scotian Shelf~~,~~ based on the 2007 Canadian component of the Trans-North

Atlantic Sighting Survey (TNASS) survey was, is 2,612 (CV=0.26) whales (Lawson and Gosselin 2011).

An abundance of 587331 (CV=0.468) humpback whales was estimated from a line--transect survey conducted betweenduring n June and m JulyAugust 2011 by ship and plane. The aerial portion covered 6,850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy).- The shipboard portion covered 3,811 km of tracklines that were in waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ. Both sighting platforms used a two-simultaneous-team data collection procedure, which allows estimation of abundance corrected for perception bias (Laake and Borchers, 2004). Estimation of abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). Coverage for this effort was similar to 2004 and would have notThis estimate did not include the portion of the Scotian Shelf that is known to be part of the range used by Gulf of Maine humpback whalesdoes not accounted for that part of the Gulf of Maine stock presumed represented by 25% of the humpbacks resident on the Scotian Shelf south of Halifax, Nova Scotia. These various line--transects surveys lack consistency in geographic coverage, and because of the mobility of humpback whales, pooling stratum estimates across years to produce a single estimate is not advisable. However, similar to an estimate that appeared in Clapham et al. (2003), Robbins (2010) used photo-id evidence of presence to calculate the minimum number alive of catalogued individuals seen during the 2008 feeding season within the Gulf of MaineOM, or seen both before and after 2008, plus whales seen for the first time as non-calves in 2009. -That procedure placed the minimum number alive at 823 animals.

Minimum Population Estimate

For statistically--based estimates, tThe 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 most recent line--transect survey, which Despitedid not includeing the Scotian Shelf portion of the stock, the most recent survey results represent the The bestproduced an estimate of abundance for Gulf of Maine humpback whales and isof 847 587331 animals (CV=0.550.486). The with a resultant minimum population estimate for this stock ofis 549 4065 228 animals. -The line-transect based Nmin is unrealistic because at least 500 uniquely identifiable individual whales from the GOM stock were seen during the calendar year of that survey and the actual population would have been larger because re-sighting rates of GOM humpbacks have historically been <1. Using the minimum count from at least 2 years prior to the year of a stock assessment report allows time to resight whales known to be alive prior to and after the focal year.Because this represents such an unlikely decline from a minimum count of 823 whales known to be alive during 2009, Thus the minimum population estimate is set to the 2008 mark--recapture based count of 823.

Table 1. Summary of abundance estimates for Gulf of Maine humpback whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Type	N_{best}	CV
Jun-Jul 2004	Gulf of Maine to lower Bay of Fundy	359	0.75
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	847	0.55
Jun-Oct 2008	Gulf of Maine and Bay of Fundy	823	0
Jun-Aug 2011	North Carolina to lower Bay of Fundy	587331	0.468

Current Population Trend

As detailed below, current data suggest that the Gulf of Maine humpback whale stock is steadily increasing in size. This is consistent with an estimated average trend of 3.1% (SE=0.005) in the North Atlantic population overall for the period 1979-1993 (Stevick *et al.* 2003), although there are no feeding-area-specific estimates.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Zerbini et al. (2010) reviewed various estimates of maximum productivity rates for humpback whale populations, and, ~~. B~~based on ~~thereir own Monte Carlo~~ simulation studies, they proposed that 11.8% be ~~used~~considered as the maximum ~~amount~~rate ~~the~~ at which the species could grow. ~~Although their work incorporated the uncertainty in demographic parameters sampled around the globe, they are not specific to any one stock. Stocks of baleen whales typically represent a set of feeding aggregations whose reproductive performance and survival functions would be driven by conditions within the stock's geographic boundaries. As a result, i It is unclear, therefore, how applicable their conclusion is to the Gulf of Maine Stock.~~

Barlow and Clapham (1997), applying an interbirth interval model to photographic mark-recapture data, estimated the population growth rate of the Gulf of Maine humpback whale stock at 6.5% (CV=0.012). Maximum net productivity is unknown for this population, although a theoretical maximum for any humpback population can be calculated using known values for biological parameters (Brandão *et al.* 2000; Clapham *et al.* 2001). For the Gulf of Maine stock, data supplied by Barlow and Clapham (1997) and Clapham *et al.* (1995) give values of 0.96 for survival rate, 6 years as mean age at first parturition, 0.5 as the proportion of females, and 0.42 for annual pregnancy rate. From this, a maximum population growth rate of 0.072 is obtained according to the method described by Brandão *et al.* (2000). This suggests that the observed rate of 6.5% (Barlow and Clapham 1997) is close to the maximum for this stock.

Clapham *et al.* (2003) updated the Barlow and Clapham (1997) analysis using data from the period 1992 to 2000. The population growth estimate was either 0% (for a calf survival rate of 0.51) or 4.0% (for a calf survival rate of 0.875). Although confidence limits were not provided (because maturation parameters could not be estimated), both estimates of population growth rate are outside the 95% confidence intervals of the previous estimate of 6.5% for the period 1979 to 1991 (Barlow and Clapham 1997). More recent work by Robbins (2007) places apparent survival of calves at 0.664 (95% CI: 0.517-0.784), a value intermediate between those used by Barlow and Clapham (1997).

~~In light of~~Despite the uncertainty accompanying the more recent estimates of observed population growth rate for the Gulf of Maine stock, the maximum net productivity rate was assumed to be ~~to be the~~ 6.5% calculated by Barlow and Clapham (1997) because it represents an observation greater than the default of 0.04 for cetaceans (Barlow *et al.* 1995)~~,~~ but is conservative in that it is well below the results of Zerbini et al. (2010).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Gulf of Maine stock is ~~549 22565~~823 whales. The maximum productivity rate is ~~the default value of~~ 0.0654. The ~~"recovery"~~recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because this stock is listed as an endangered species under the Endangered Species Act (ESA). PBR for the Gulf of Maine humpback whale stock is ~~1.51 0.5~~2.7 whales.

ANNUAL HUMAN-CAUSED SERIOUS INJURY AND MORTALITY

For the period ~~2005~~ 2006 through ~~2009~~2010, the minimum annual rate of human-caused mortality and serious injury to the Gulf of Maine humpback whale stock averaged ~~5.0~~7.~~6~~8 animals per year (U.S. waters, ~~5.0~~7.~~4~~2; Canadian waters, 0.~~2~~6). This value includes incidental fishery interaction records, ~~3.6~~5.~~6~~8 (U.S. waters, ~~3.6~~5.~~4~~2; Canadian waters, 0.~~2~~6); and records of vessel collisions, ~~1.4~~2.0 (U.S. waters, ~~1.4~~2.0; Canadian waters, 0) (Henry *et al.* ~~2011~~2012).

In contrast to stock assessment reports before 2007, these averages include humpback mortalities and serious injuries that occurred in the southeastern and mid-Atlantic states that could not be confirmed as involving members of the Gulf of Maine stock. In past reports, only events involving whales confirmed to be members of the Gulf of Maine stock were counted against the PBR. Starting in the 2007 report, we assumed whales were from the Gulf of Maine unless they were identified as members of another stock. At the time of this writing, no whale was identified as a member of another stock. These determinations may change with the availability of new information. Canadian records from the southern side of Nova Scotia were incorporated into the mortality and serious injury rates, to reflect the effective range of this stock as described above. For the purposes of this report, discussion is primarily limited to those records considered confirmed human-caused mortalities or serious injuries.

Serious injury was defined in 50 CFR part 229.2 as an injury that is likely to lead to mortality. We therefore limited serious injury designations to only those reports that had substantiated evidence that the injury, whether from entanglement or vessel collision, was likely to lead to the whale's death. Determinations of serious injury were made on a case-by-case basis following recommendations from the workshop conducted in 1997 on differentiating serious and non-serious injuries (Angliss and DeMaster 1998). Injuries that impeded a whale's locomotion or feeding were not considered serious injuries unless they were likely to be fatal in the foreseeable future. There was no forecasting of how the entanglement or injury might increase the whale's susceptibility to further injury, namely from additional entanglements or vessel collisions. For these reasons, the human impacts listed in this report represent a minimum estimate.

To better assess human impacts (both vessel collision and gear entanglement) there needs to be greater emphasis on the timely recovery of carcasses and complete necropsies. The literature and review of records described here suggest that there are significant human impacts beyond those recorded in the data assessed for serious injury and mortality. For example, a study of entanglement-related scarring on the caudal peduncle of 134 individual humpback whales in the Gulf of Maine suggested that between 48% and 65% had experienced entanglements (Robbins and Mattila 2001). Decomposed and/or unexamined animals (e.g., carcasses reported but not retrieved or no necropsy performed) represent 'lost data', some of which may relate to human impacts.

Background

As with right whales, human impacts (vessel collisions and entanglements) may be slowing recovery of the humpback whale population. Of 20 dead humpback whales (principally in the mid-Atlantic, where decomposition did not preclude examination for human impacts), Wiley *et al.* (1995) reported that six (30%) had major injuries possibly attributable to ship strikes, and five (25%) had injuries consistent with entanglement in fishing gear. One whale displayed scars that may have been caused by both ship strike and entanglement. Thus, 60% of the whale carcasses suitable for examination showed signs that anthropogenic factors may have contributed to, or been responsible for, their death. Wiley *et al.* (1995) further reported that all stranded animals were sexually immature, suggesting a winter or migratory segregation and/or that juvenile animals are more susceptible to human impacts.

An updated analysis of humpback whale mortalities from the mid-Atlantic ~~states~~ region was produced by Barco *et al.* (2002). Between 1990 and 2000, there were 52 known humpback whale mortalities in the waters of the U.S. mid-Atlantic states. Inspection of length data from 48 of these whales (18 females, 22 males, and 8 of unknown sex) suggested that 39 (81.2%) were first-year animals, 7 (14.6%) were immature, and 2 (4.2%) were adults. However, sighting histories of five of the dead whales indicate that some were small for their age, and histories of live whales further indicate that the proportion of mature whales in the mid-Atlantic may be higher than suggested by the stranded sample.

Robbins and Mattila (2001) reported that males were more likely to be entangled than females. Their scarring data suggested that yearlings were more likely than other age classes to be involved in entanglements. Humpback whale entanglements also occur in relatively high numbers in Canadian waters. Reports of interactions with fixed fishing gear set for groundfish around Newfoundland averaged 365 annually from 1979 to 1987 (range 174-813). An average of 50 humpback whale entanglements (range 26-66) was reported annually between 1979 and 1988, and 12 of 66 humpback whales entangled in 1988 died (Lien *et al.* 1988). ~~Two humpbacks were reported entangled in fishing gear in Newfoundland and Labrador waters in 2005. One towed away the gear and was not re-sighted, and the other was released alive (Ledwell and Huntington 2006).~~ A total of 965 ~~Eighty-four~~ humpbacks were reported entangled in fishing gear in Newfoundland and Labrador from ~~2000~~ 1979 to ~~2006~~ 2008 (~~W. Ledwell, pers. comm.~~Benjamins *et al.* 2011). Volgenau *et al.* (1995) reported that in Newfoundland and Labrador, cod traps caused the most entanglements and entanglement mortalities (21%) of humpbacks between 1979 and 1992. They also reported that gillnets were the primary cause of entanglements and entanglement mortalities (20%) of humpbacks in the Gulf of Maine between 1975 and 1990. In more recent times, following the collapse of the cod fishery, groundfish gillnets for other fish species and crab pot lines have been the most common sources of humpback entanglement. One humpback whale was reported released alive (status unknown) from a herring weir off Grand Manan in 2009 (H. Koopman, UNC Wilmington, pers. comm.).

As reported by Wiley *et al.* (1995), serious injuries possibly attributable to ship strikes are more common and probably more serious than those from entanglements. However ~~I~~in the NMFS records for ~~2005~~ 2006 through ~~2009~~2010, there are ~~7~~ 10 reports of mortalities as a result of collision with a vessel and 2~~8~~9 serious injuries and mortalities attributed to entanglement. Because it has never been shown that serious injuries and mortalities related to ships or to fisheries interactions are equally detectable, it is unclear as to which human source of mortality is more prevalent. No whale involved in the recorded vessel collisions had been identified as a member of a stock other than the Gulf of Maine stock at the time of this writing (Henry *et al.* ~~2011~~2012).

Fishery-Related Serious Injuries and Mortalities

A description of fisheries is provided in Appendix III. Two mortalities were observed in the pelagic drift gillnet fishery, one in 1993 and the other in 1995. In winter 1993, a juvenile humpback was observed entangled and dead in a pelagic drift gillnet along the 200-m isobath northeast of Cape Hatteras. In early summer 1995, a humpback was entangled and dead in a pelagic drift gillnet on southwestern Georges Bank. Additional reports of mortality and serious injury, as well as description of total human impacts, are contained in records maintained by NMFS. A number of these records (11 entanglements involving lobster pot/trap gear) from the 1990-1994 period were the basis used to reclassify the lobster fishery (62 FR 33, Jan. 2, 1997). Large whale entanglements are rarely observed during fisheries sampling operations. However, during 2008, 3 humpback whales were observed as incidental bycatch: 2 in gillnet gear (1 no serious injury; 1 undetermined) and 1 in a purse seine (released alive).

For this report, the records of dead, injured, and/or entangled humpbacks (found either stranded or at sea) for the period ~~2005~~ 2006 through ~~2009~~ 2010 were reviewed. Entanglements accounted for ~~five~~ nine mortalities and ~~12~~ ~~19~~20 serious injuries and ~~was~~ were a secondary cause of mortality for another animal. With no evidence to the contrary, all events were assumed to involve members of the Gulf of Maine stock. While these records are not statistically quantifiable in the same way as observer fishery records, they provide some indication of the minimum frequency of entanglements. Of the 27 reported fisheries entanglements from U.S. waters during this 5-year time period, 17 were reported before the Atlantic Large Whale Take Reduction Plan's sinking-groundline rule went into effect in April 2009, and 10 were reported after enactment of the rule. Statistical analysis of the effectiveness of this rule is underway.

~~Table 2. Confirmed human-caused mortality and serious injury records of North Atlantic humpback whales, January 2005 - December 2009. All records were assumed to involve members of the Gulf of Maine humpback whale stock unless a whale was confirmed to be a member of another stock.~~

~~Date[a]~~	~~Report Type[b]~~	~~Age, Sex, ID, Length~~	~~Location[a]~~	~~Assigned Cause: P=primary, S=secondary~~		~~Notes/Observations~~
				~~Ship strike~~	~~Entang./ Fsh.inter~~	
~~1/9/2006~~	~~mortality~~	~~Adult Female #8667 14.0m~~	~~off Charleston, SC~~	~~P~~	-	~~Extensive muscle hemorrhaging; rib fractures; dislocated flipper on left side of animal~~
~~3/17/2006~~	~~mortality~~	~~Juvenile Female 10.0m~~	~~Virginia Beach, VA~~	~~P~~	-	~~Crushed cranium and fractured mandible; hemorrhaging associated with fractures; ventral lacerations consistent with propeller wounds~~
~~3/25/2006~~	~~serious injury~~	~~Juvenile sex unknown 8m (est)~~	~~Flagler Beach, FL~~	-	~~P~~	~~Heavy cyamid load; emaciated; spinal deformity that may or may not have been caused by the entanglement; gear recovered included line and buoys and was identified as lobster pot gear~~
~~8/6/2006~~	~~serious injury~~	~~age & sex unknown~~	~~Georges Bank~~	-	~~P~~	~~Multiple constricting wraps around head; line cutting into upper lip; wraps around both flippers; no gear recovered~~

8/23/2006	serious injury	age & sex unknown 12m (est)	Great South Channel	-	P	Flukes necrotic and nearly severed as a result of entanglement; pale skin and emaciated; gear recovered included heavy line and wire trap
09/06/06[b]	mortality	age & sex unknown	East of Cape Cod, MA	-	P	Whale entangled through mouth, continuing back to multiple wraps around peduncle; no gear recovered
10/15/2006	mortality	Juvenile Female 10.1m	off Fenwick Island, DE	P	S	Large laceration, penetrating through the bone, across rostrum with accompanying fractures; no gear, but marks around right flipper consistent with entanglement; subdermal hemorrhaging and bone trauma at entanglement point
1/27/2007	serious injury	age & sex unknown	off Beach Haven, NJ	-	P	Body wrap likely to become constricting; random cyamid patches; thin body condition; probable flipper wraps; no gear recovered
5/10/2007	mortality	Adult Female 12.5m	off Wachapreague, VA	P	-	Cranium shattered, hemorrhaging on left lateral side midway between flippers & fluke
5/13/2007	mortality	Juvenile Male 9.3m	Rockport, MA	P	-	Areas of hemorrhaging indicate major blunt trauma to chest, neck, & head
6/23/2007	serious injury	age unknown Male "Egg Toss"	Wildcat Knoll	-	P	Body wrap of gear imbedded; no gear recovered
6/24/2007	mortality	Juvenile Female "Tofu" 9.9m	Stellwagen Bank	P	-	Subdermal hemorrhaging involving blubber, fascia, & muscle extending from/around the insertion of the right flipper ventrally to the axilla
12/21/2007	mortality	age unknown Male 9.4m	Ocean Sands, Corolla, NC	-	P	Documented wrapped in gear, gear removed without permission prior to necropsy; external lesions at flukes, flippers, mouth, dorsal fin, dorsal keel, & ventral pleats consistent with gillnet entanglement; emaciated; no gear recovered
1/6/2008	serious injury	age & sex unknown 10m (est)	off Cape Lookout, NC	-	P	Constricting line cutting into right flipper in several places; heavy cyamid load; emaciated; no gear recovered
5/30/2008	mortality	age & sex unknown	Georges Bank	-	P	Constricting body wraps, one wrap under lower jaw; open wound on right flipper; no gear recovered

6/9/2008	mortality	age & sex unknown	Georges Bank	-	P	Constricting body wrap; gear analysis pending
7/8/2008	serious injury	Adult Female "Estuary"	off Nauset, MA	-	P	Cuts were made, but no gear was removed; emaciated; moderate cyamid coverage; deep wounds in fluke blades from gear; hunched over position maintained after cuts were made to the gear; gear analysis pending
8/13/2008	serious injury	age & sex unknown 10m (est)	off NJ	-	P	Partial disentanglement; emaciated; lethargic; heavy cyamid load; gear analysis pending
8/21/2008	serious injury	age & sex unknown	off Chatham, MA	-	P	Evidence of decline in health; no gear recovered
11/4/2008	mortality	Juvenile Male 10.1m	Assateague Island, MD	P	-	Cranial fractures with associated hemorrhaging
2/8/2009	mortality	age unknown Male 9.7m	Cape Fear, NC	-	P	Evidence of entanglement at mouthline, peduncle, and flipper with associated hemorrhaging; emaciated; no gear present
2/16/2009	mortality	Juvenile Male 10.0m	Nags Head, NC	-	P	Evidence of entanglement involving anchoring or heavily weighted gear with associated hemorrhaging; no gear present
2/25/2009	serious injury	Juvenile sex unknown	off Sandy Hook, NJ	-	P	Disentangled from anchoring pot gear; maintained hunched body position post-disentanglement; gear analysis pending
6/9/2009	serious injury	age & sex unknown	Stellwagen Bank	-	P	Constricting body wrap just forward of the flippers; no gear recovered

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

b. Record was added after review of carcasses sighted on 08/20/06 and 09/06/06. Previous reports stated these were the same animal. Recent review could not confirm the resight, therefore they are now being treated as two separate events. There was inconclusive evidence with regard to the carcass on 08/20/06 to determine mortality caused by entanglement.

Table 2. Confirmed human-caused mortality and serious injury records of North Atlantic humpback whales, January 2006 - December 2010. All records were assumed to involve members of the Gulf of Maine humpback whale stock unless a whale was confirmed to be a member of another stock.

Date[a]	Report Type	Age, Sex, ID, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
-			-	-		-
-	-	-	-	-	-	-

- -	- -	- -	- -	Ship strike -	Entanglement/ Fishery interaction	- -
1/9/2006	mortality	Adult Female #8667 14.0m	off Charleston, SC	P	-	Extensive muscle hemorrhaging; rib fractures; dislocated flipper on left side of animal
3/17/2006	mortality	Juvenile Female 10.0m	Virginia Beach, VA	P	-	Crushed cranium and fractured mandible; hemorrhaging associated with fractures; ventral lacerations consistent with propeller wounds
3/25/2006	serious injury	Juvenile sex unknown 8m (est)	Flagler Beach, FL (confirmed Canadian gear)[b] ~~Flagler Beach, FL~~	-	P	Heavy cyamid load; emaciated; spinal deformity that may or may not have been caused by the entanglement; gear recovered included line and buoys and was identified as Canadian lobster pot gear
8/6/2006	serious injury	age & sex unknown	Georges Bank	-	P	Multiple constricting wraps around head; line cutting into upper lip; wraps around both flippers; no gear recovered
8/23/2006	serious injury	age & sex unknown 12m (est)	Great South Channel	-	P	Flukes necrotic and nearly severed as a result of entanglement; pale skin and emaciated; gear recovered included heavy line and wire trap
09/06/06[bc]	mortality	age & sex unknown	East of Cape Cod, MA	-	P	Whale entangled through mouth, continuing back to multiple wraps around peduncle; no gear recovered

09/27/06[d]	serious injury	age & sex unknown	off Cape May, NJ		P	Line anchored in mouthline & crosses over back; extent of entanglement unknown but animal is emaciated
10/15/2006	mortality	Juvenile Female 10.1m	off Fenwick Island, DE	P	S	Large laceration, penetrating through the bone, across rostrum with accompanying fractures; no gear, but marks around right flipper consistent with entanglement; subdermal hemorrhaging and bone trauma at entanglement point
1/27/2007	serious injury	age & sex unknown	off Beach Haven, NJ	_	P	Body wrap likely to become constricting; random cyamid patches; thin body condition; probable flipper wraps; no gear recovered
5/10/2007	mortality	Adult Female 12.5m	off Wachapreague, VA	P	_	Cranium shattered, hemorrhaging on left lateral side midway between flippers & fluke
5/13/2007	mortality	Juvenile Male 9.3m	Rockport, MA	P	_	Areas of hemorrhaging indicate major blunt trauma to chest, neck, & head
6/23/2007	serious injury	age unknown Male "Egg Toss"	Wildcat Knoll	_	P	Body wrap of gear imbedded; no gear recovered

6/24/2007	mortality	Juvenile Female "Tofu" 9.9m	Stellwagen Bank	P	_	Subdermal hemorrhaging involving blubber, fascia, & muscle extending from/around the insertion of the right flipper ventrally to the axilla
12/21/2007	mortality	age unknown Male 9.4m	Ocean Sands, Corolla, NC	_	P	Documented wrapped in gear, gear removed without permission prior to necropsy; external lesions at flukes, flippers, mouth, dorsal fin, dorsal keel, & ventral pleats consistent with gillnet entanglement; emaciated; no gear recovered
1/6/2008	serious injury	age & sex unknown 10m (est)	off Cape Lookout, NC	_	P	Constricting line cutting into right flipper in several places; heavy cyamid load; emaciated; no gear recovered
5/30/2008	mortality	age & sex unknown	Georges Bank	_	P	Constricting body wraps, one wrap under lower jaw; open wound on right flipper; no gear recovered
6/9/2008	mortality	age & sex unknown	Georges Bank	_	P	Constricting body wrap; gear analysis pending
7/8/2008	serious injury	Adult Female "Estuary"	off Nauset, MA	_	P	Cuts were made, but no gear was removed; emaciated; moderate cyamid coverage; deep wounds in fluke blades from gear; hunched over position maintained after cuts were made to the gear; gear analysis pending

8/13/2008	serious injury	age & sex unknown 10m (est)	off NJ	_	P	Partial disentanglement; emaciated; lethargic; heavy cyamid load; gear analysis pending
8/21/2008	serious injury	age & sex unknown	off Chatham, MA	_	P	Evidence of decline in health; no gear recovered
11/4/2008	mortality	Juvenile Male 10.1m	Assateague Island, MD	P	_	Cranial fractures with associated hemorrhaging
2/8/2009	mortality	age unknown Male 9.7m	Cape Fear, NC	_	P	Evidence of entanglement at mouthline, peduncle, and flipper with associated hemorrhaging; emaciated; no gear present
2/16/2009	mortality	Juvenile Male 10.0m	Nags Head, NC	_	P	Evidence of entanglement involving anchoring or heavily weighted gear with associated hemorrhaging; no gear present
2/25/2009	serious injury	Juvenile sex unknown	off Sandy Hook, NJ	_	P	Disentangled from anchoring gear; maintained hunched body position post-disentanglement; no gear recovered
6/9/2009	serious injury	age & sex unknown	Stellwagen Bank	_	P	Constricting body wrap just forward of the flippers; no gear recovered
12/9/2009	serious injury	age & sex unknown	off Jacksonville, FL (confirmed Canadian gear)[b]	_	P	Disentangled; evidence of health decline; Canadian gillnet gear
3/7/2010	serious injury	age & sex unknown	off Ponte Vedre, FL	_	P	Constricting body & flipper wraps; evidence of severe health decline

3/13/2010	mortality	Juvenile Female 9.1m	Ocean City, MD	P	_	Skull fractures with associated hemorrhaging
5/5/2010	serious injury	Juvenile sex unknown	Chesapeake Bay	_	P	Gear likely to become constricting as animal grows; evidence of health decline; no gear recovered
5/8/2010	mortality	Adult Female 9.8m	Narragansett, RI	_	P	Evidence of constricting gear with associated hemorrhaging; fluid filled lungs; gear analysis pending
5/15/2010	serious injury	Juvenile Male 8.8m	off Hatteras Inlet, NC	_	P	Live stranded; euthanized; necrotic infected injuries consistent with entanglement; no gear present
5/18/2010	serious injury	Adult sex unknown "Pinch"	Stellwagen Bank	_	P	Constricting body wrap; no gear recovered
5/28/2010	mortality	Adult Female 11.2m	Edgartown, MA	_	P	Evidence of entanglement with associated bruising & edema; gear analysis pending
6/10/2010	mortality	Juvenile Male 9.6m	Jones Beach State Park, NY	P	_	Extensive hemorrhage & edema on right dorsal lateral surface
7/4/2010	mortality	Juvenile Female 8.7m	off Assateague, MD	P	_	Extensive hemorrhage & edema to left lateral area
8/13/2010	serious injury	age & sex unknown	off Nauset, MA	_	P	Head wrap likely to become constricting; gear analysis pending
8/20/2010	serious injury	Juvenile sex unknown 2008 calf of "Trident"	Stellwagen Bank	_	P	Embedded peduncle wrap; evidence of health decline; no gear recovered

11/27/2010	mortality	Juvenile Male 7.5m (est)	Bay of Fundy, Canada	-	P	Evidence of constricting wraps on fluke, peduncle, and flipper; no gear recovered
12/23/2010	serious injury	age & sex unknown	off Port Everglades Inlet, FL	-	P	Evidence of entanglement & severe health decline; no gear present

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.
b. Gear origin not included in previous reports.
bc. Record was added after review of carcasses sighted on 08/20/06 and 09/06/06. Previous reports stated these were the same animal. Recent review could not confirm the resight; therefore they are now being treated as two separate events. There was inconclusive evidence with regard to the carcass on 08/20/06 to determine mortality caused by entanglement.
d. Record was added after review of event; not included in previous reports

Other Mortality

Between November 1987 and January 1988, at least 14 humpback whales died after consuming Atlantic mackerel containing a dinoflagellate saxitoxin (Geraci *et al.* 1989). The whales subsequently stranded or were recovered in the vicinity of Cape Cod Bay and Nantucket Sound, and it is highly likely that other unrecorded mortalities occurred during this event. During the first six months of 1990, seven dead juvenile (7.6 to 9.1 m long) humpback whales stranded between North Carolina and New Jersey. The significance of these strandings is unknown.

In July 2003, an Unusual Mortality Event (UME) was invoked in offshore waters when an estimated minimum of 12-15 humpback whales died in the vicinity of the Northeast Peak of Georges Bank. Preliminary tests of samples taken from some of these whales were positive for domoic acid at low levels, but it is currently unknown what levels would affect the whales and therefore no definitive conclusions can yet be drawn regarding the cause of this event or its effect on the status of the Gulf of Maine humpback whale population. Seven humpback whales were considered part of a large whale UME in New England in 2005. Twenty-one dead humpback whales found between 10 July and 31 December 2006 triggered a humpback whale UME declaration. Causes of these UME events have not been determined.

STATUS OF STOCK

NMFS recently concluded a global humpback whale status review, the report of which is expected to be completed in 2012. NMFS will include the relevant results of this review in the SARs when they are available. The status of the North Atlantic humpback whale population was the topic of an International Whaling Commission Comprehensive Assessment in June 2001, and again in May 2002. These meetings conducted a detailed review of all aspects of the population and made recommendations for further research (IWC 2002). Although recent estimates of abundance indicate continued population growth, the size of the humpback whale stock may be below OSP in the U.S. Atlantic EEZ. This is a strategic stock because the humpback whale is listed as an endangered species under the ESA. A Recovery Plan was published and is in effect (NMFS 1991). There are insufficient data to reliably determine current population trends for humpback whales in the North Atlantic overall. The average annual rate of population increase was estimated at 3.1% (SE=0.005, Stevick *et al.* 2003). An analysis of demographic parameters for the Gulf of Maine (Clapham *et al.* 2003) suggested a lower rate of increase than the 6.5% reported by Barlow and Clapham (1997), but results may have been confounded by distribution shifts. The total level of U.S. fishery-caused mortality and serious injury is unknown, but reported levels are more than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant or approaching zero mortality and serious injury rate. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the North Atlantic humpback whale is an endangered species.

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FIN WHALE (*Balaenoptera physalus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The Scientific Committee of the International Whaling Commission (IWC) has proposed stock boundaries for North Atlantic fin whales. Fin whales off the eastern United States, Nova Scotia and the southeastern coast of Newfoundland are believed to constitute a single stock under the present IWC scheme (Donovan 1991). However, the stock identity of North Atlantic fin whales has received relatively little attention, and whether the current stock boundaries define biologically isolated units has long been uncertain. The existence of a subpopulation structure was suggested by local depletions that resulted from commercial overharvesting (Mizroch *et al.* 1984).

A genetic study conducted by Bérubé *et al.* (1998) using both mitochondrial and nuclear DNA provided strong support for an earlier population model proposed by Kellogg (1929) and others. This postulates the existence of several subpopulations of fin whales in the North Atlantic and Mediterranean with limited gene flow among them. Bérubé *et al.* (1998) also proposed that the North Atlantic population showed recent divergence due to climatic changes (i.e., postglacial expansion), as well as substructuring over even relatively short distances. The genetic data are consistent with the idea that different subpopulations use the same feeding ground, a hypothesis that was also originally proposed by Kellogg (1929).

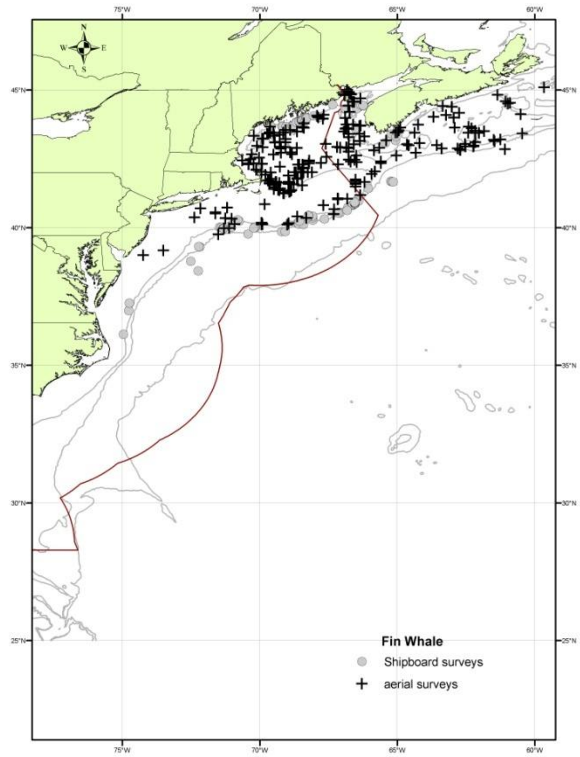

Figure 1. *Distribution of fin whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006 ~~and~~, 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Fin whales are common in waters of the U. S. Atlantic Exclusive Economic Zone (EEZ), principally from Cape Hatteras northward (Figure 1). Fin whales accounted for 46% of the large whales and 24% of all cetaceans sighted over the continental shelf during aerial surveys (CETAP 1982) between Cape Hatteras and Nova Scotia during 1978-82. While much remains unknown, the magnitude of the ecological role of the fin whale is impressive. In this region fin whales are ~~probably~~ the dominant large cetacean species during all seasons, having the largest standing stock, the largest food requirements~~,~~; and, therefore, the largest ~~impact~~ influence on ~~the~~ ecosystem processes of any cetacean species (Hain *et al.* 1992; Kenney *et al.* 1997).

New England waters represent a major feeding ground for fin whales. There is evidence of site fidelity by females, and perhaps some segregation by sexual, maturational or reproductive class in the feeding area (Agler *et al.* 1993). Seipt *et al.* (1990) reported that 49% of fin whales sighted on the Massachusetts Bay area feeding grounds were resighted within the same year, and 45% were resighted in multiple years. The authors suggested that fin whales on these grounds exhibited patterns of seasonal occurrence and annual return that in some respects were similar to those shown for humpback whales. This was reinforced by Clapham and Seipt (1991), who showed maternally-directed site fidelity for fin whales in the Gulf of Maine.

~~Information on life history and vital rates is also available in data from the Canadian fishery, 1965-1971 (Mitchell 1974). In seven years, 3,528 fin whales were taken at three whaling stations. The station at Blandford,~~

~~Nova Scotia, took 1,402 fin whales.~~

Hain *et al.* (1992), based on an analysis of neonate stranding data, suggested that calving takes place during October to January in latitudes of the U.S. mid-Atlantic region; however, it is unknown where calving, mating, and wintering occurs for most of the population. Results from the Navy's SOSUS program (Clark 1995) indicate a substantial deep-ocean distribution of fin whales. It is likely that fin whales occurring in the U.S. Atlantic EEZ undergo migrations into Canadian waters, open-ocean areas, and perhaps even subtropical or tropical regions. However, the popular notion that entire fin whale populations make distinct annual migrations like some other mysticetes has questionable support in the data; in the North Pacific, year-round monitoring of fin whale calls found no evidence for large-scale migratory movements (Watkins *et al.* 2000).

POPULATION SIZE

The best abundance estimate available for the western North Atlantic fin whale stock is 3,~~985~~ 522 (CV=0.~~24~~27). This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007 and is considered best because it covered more of the fin whale range than the other surveys. ~~This is the sum of the estimate derived from the August 2006 Gulf of Maine survey and the estimate derived from the July-August 2007 northern Labrador to Scotian Shelf survey. The abundance estimates of fin whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified fin whales to the total number of positively identified fin whales and positively identified sei whales.~~

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates. As recommended in the GAMMS II Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An abundance estimate of 1,925 (CV=0.55) fin whales was derived 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 trackline in waters north of Maryland (38ºN) (Table 1; Palka 2006). Shipboard data were collected using the two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance of 2,269 (CV=0.37) fin whales was estimated from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An ~~An~~ abundance estimate of 3,522 ~~1,716~~ (CV=0.~~26~~27) fin whales was generated from the ~~Canadian Trans - North Atlantic Sighting Survey (~~TNASS~~)~~ in July-August 2007. This aerial survey covered the area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. ~~Estimates from this survey have not yet been corrected for availability and perception biases~~ (Lawson and Gosselin ~~2009~~2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (M~~C~~RDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (2007) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 3,628 (CV=0.24) fin whales was generated from a shipboard and aerial survey conducted during June-August 2011. The aerial portion covered 6,850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m depth contour~~,~~ through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004).

Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the ~~mark-recapture distance sampling (~~MRDS~~)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimates of fin whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified fin whales to the total number of positively identified fin whales and positively identified sei whales; the CV of the abundance estimate includes the variance of the estimated fraction.~~.~~

Table 1. Summary of recent abundance estimates for western North Atlantic fin whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).			
Month/Year	Area	N_{best}	CV
Jun-July 2004	Gulf of Maine to lower Bay of Fundy	1,925	0.55
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	2,269	0.37
July-Aug 2007	N. Labrador to Scotian Shelf	~~1716~~3,522	0.~~26~~27
Jun-Aug 2011	North Carolina to lower Bay of Fundy	~~2,235~~3,628	0.~~36~~2~~4~~7
~~Jun- 2011Aug 2006+Jul-Aug 2007~~	~~S. Gulf of Maine to N. Labrador (COMBINED)~~	~~3,95185~~	~~0.234~~

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 fin whales is 3,~~95185~~522 (CV=0.2~~34~~7). The minimum population estimate for the western North Atlantic fin whale is ~~3,26192~~2, 817.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Based on photographically identified fin whales, Agler *et al.* (1993) estimated that the gross annual reproduction rate was ~~at~~ 8%, with a mean calving interval of 2.7 years.

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"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~3,26192~~2,817. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~recovery factor, which accounts for endangered, depleted, or threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.10 because the fin whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic fin whale is ~~6.5~~5.6.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period ~~2005~~ 2006 through ~~2009~~2010, the minimum annual rate of human-caused mortality and serious injury to fin whales was 2.~~6~~ 0 per year (U.S. waters, ~~2.0~~1.8; Canadian waters, 0.~~6~~2). This value includes incidental fishery interaction records, 0.8 (U.S. waters, 0.6; Canadian waters, 0.2); and records of vessel collisions, 1.~~8~~ 2 (U.S. waters, 1.~~4~~2; Canadian waters, 0~~.4~~)(Henry *et al.* ~~2011~~2012). Annual rates calculated from ~~Detected~~ detected mortalities should not be considered an unbiased representation of human-caused mortality, but they represent a definitive lower bound. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

Fishery-Related Serious Injury and Mortality

No confirmed fishery-related mortalities or serious injuries of fin whales have been reported in the NMFS Sea Sampling bycatch database. A review of the records of stranded, floating or injured fin whales for the period ~~2005~~ 2006 through ~~2009~~ 2010 on file at NMFS found two records with substantial evidence of fishery interactions causing mortality, and two records resulting in serious injury (Table 2), which results in ~~an~~ a minimum annual rate of serious injury and mortality of 0.8 fin whales from fishery interactions. ~~While t~~These records are not statistically quantifiable in the same way as the observer fishery records, and they ~~give a minimum~~ almost surely undercount ~~of~~ entanglements for the ~~species~~stock.

~~Table 2. Confirmed human-caused mortality and serious injury records of western North Atlantic fin whales, January 2005 - December 2005.~~

~~Date[a]~~	~~Report Type[b]~~	~~Age, Sex, Length~~	~~Location[a]~~	~~Assigned Cause: P=primary, S=secondary~~		~~Notes/Observations~~
				~~Ship strike~~	~~Entang./ Fsh.inter~~	
~~3/26/2005~~	~~mortality~~	~~Adult[b] Female 16.3m~~	~~off Virginia Beach, VA~~	~~P~~	~~-~~	~~Extensive hemorrhaging and vertebral fractures~~
~~4/3/2005~~	~~mortality~~	~~Adult[b] Female 18.8m~~	~~Southampton, NY~~	~~P~~	~~-~~	~~Subdermal hemorrhaging~~
~~8/23/2005~~	~~mortality~~	~~Juvenile[b] Male 13.7m~~	~~Port Elizabeth, NJ~~	~~P~~	~~-~~	~~Fresh carcass on bow of ship; extensive hemmorhaging on right side of body~~
~~9/11/2005~~	~~mortality~~	~~Juvenile[b] Male 11.0m~~	~~Bonne-Esperance, QC~~	~~P~~	~~-~~	~~Bottom jaw completely severed/broken~~
~~09/13/05[c]~~	~~mortality~~	~~age & sex unknown~~	~~Blanc Sablon, NL~~	~~P~~	~~-~~	~~Lower jaw broken associated with massive areas of bruising~~
~~9/17/2006~~	~~serious injury~~	~~age & sex unknown 18m (est)~~	~~off Mt. Desert Rock, ME~~	~~-~~	~~P~~	~~Pale skin overall; cyamid load at point of attachment; emaciated; no gear recovered~~

3/25/2007	mortality	age unknown Female 18.0m	Norfolk, VA	P	-	Extensive fracturing of ribs, skull, and vertebrae w/ associated hemorrhage & edema
5/24/2007	mortality	age unknown Male	Newark Bay, NJ	P	-	Hemorrhage (epaxial muscle, diaphragm, pleural lining) and multiple fractures of the ribs, vertebrae, & sternum and the trailing tissue of the animal was marked by propeller cuts
6/25/2007	serious injury	age & sex unknown	Great South Channel	-	P	Wrap on tail assoc w/ cyamid load; flippers & mouth involved; extremely emaciated; lethargic; no gear recovered
8/11/2007	mortality	age & sex unknown	Cabot Strait, NS	-	P	Constricting wrap around body, between the head and flippers; no gear recovered
9/26/2007	mortality	Juvenile Male 13m (est)	off Martha's Vineyard, MA	-	P	Freshly dead, scavenged carcass with gear present; evidence of multiple body wraps with associated hemorrhaging; no gear recovered
7/2/2008	mortality	age unknown Male 14.8m	Barnegat Inlet, NJ	P	-	Vertebral fractures with associated hemorrhaging; hemorrhaging around ball joint of right flipper
10/1/2009	mortality	age & sex unknown	Port Elizabeth, NJ	P	-	Fresh carcass with broken flipper, hematomas, and abrasions

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

b. The gender and length were misreported in the 2006 Stock Assessment Report. This table shows the correct values.

c. Additional record which was not included in previous reports.

Table 2. Confirmed human-caused mortality and serious injury records of Western North Atlantic fin whales *(Balaenoptera physalus)*, 2006 - 2010.

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entanglement/ Fishery interaction	
9/17/2006	serious injury	age & sex unknown 18m (est)	off Mt. Desert Rock, ME	-	P	Pale skin overall; cyamid load at point of attachment; emaciated; no gear recovered
3/25/2007	mortality	age unknown Female 18.0m	Norfolk, VA	P	-	Extensive fracturing of ribs, skull, and vertebrae w/ associated hemorrhage & edema
5/24/2007	mortality	age unknown Male	Newark Bay, NJ	P	-	Hemorrhage (epaxial muscle, diaphragm, pleural lining) and multiple fractures of the ribs, vertebrae, & sternum and the trailing tissue of the animal was marked by propeller cuts
6/25/2007	serious injury	age & sex unknown	Great South Channel	-	P	Wrap on tail assoc w/ cyamid load; flippers & mouth involved; extremely emaciated; lethargic; no gear recovered
8/11/2007	mortality	age & sex unknown	Cabot Strait, NS	-	P	Constricting wrap around body, between the head and flippers; no gear recovered
9/26/2007	mortality	Juvenile Male 13m (est)	off Martha's Vineyard, MA	-	P	Freshly dead, scavenged carcass with gear present; evidence of multiple body wraps with associated hemorrhaging; no gear recovered

7/2/2008	mortality	age unknown Male 14.8m	Barnegat Inlet, NJ	P		Vertebral fractures with associated hemorrhaging; hemorrhaging around ball joint of right flipper
10/1/2009	mortality	age & sex unknown	Port Elizabeth, NJ	P		Fresh carcass with broken flipper, hematomas, and abrasions
3/18/2010	mortality	Adult Female 18.6m	off Bethany Beach, DE	P		Fractured skull w/ associated hemorrhaging; abrasion mid-dorsal consistent w/ being folded over the bow of a ship
9/3/2010	mortality	Juvenile Male 9.5m	Cape Henlopen State Park, DE	P		Large laceration & vertebral fractures with associated hemorrhaging

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

Other Mortality

After reviewing NMFS records for 2005 2006 through 20092010, nine six were found that had sufficient information to confirm the cause of death as collisions with vessels (Table 2; Henry *et al*. 20112012). These records constitute an annual rate of serious injury or mortality of 1.8 2 fin whales from vessel collisions. The number of fin whales taken at three whaling stations in Canada from 1965 to 1971 totaled 3,528 whales (Mitchell 1974).

STATUS OF STOCK

This is a strategic stock because the fin whale is listed as an endangered species under the ESA. The total level of human-caused mortality and serious injury is unknown. NMFS records represent coverage of only a portion of the area surveyed for the population estimate for the stock. The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is is likely biased low and is still not less than 10% of the calculated PBR. Therefore entanglement rates cannot be considered insignificant and approaching the ZMRG. TThe 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 trend for fin whales. A final recovery plan for the fin whale was published in 2010 (NMFS 2010). The total level of human-caused mortality and serious injury is unknown. NMFS records represent coverage of only a portion of the area surveyed for the population estimate for the stock. The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is is likely biased low and is still not less than 10% of the calculated PBR., and tTherefore entanglement rates cannot be considered insignificant and approaching the ZMRG. This is a strategic stock because the fin whale is listed as an endangered species under the ESA.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

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 International Whaling Committee (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.

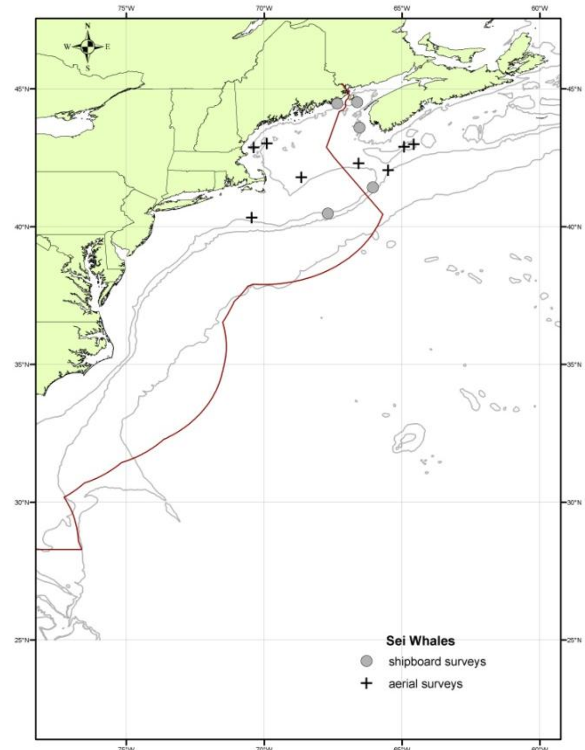

Figure 1. *Distribution of sei whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, ~~and~~ 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Indications are that, at least during the feeding season, a major portion of the Nova Scotia sei whale stock 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. Spring is the period of greatest abundance in U.S. waters, 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 from 1999 on have 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, in particular 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 shallower, more inshore waters. Although known to eat fish, sei whales (like right whales) are largely planktivorous, feeding primarily on euphausiids and copepods (Flinn *et al.* 2002). A review by prey preferences by Horwood (1987) showed that in the North Atlantic sei whales seem to prefer copepods over all other prey species. In Nova Scotia sampled stomachs from captured sei whales showed a clear preference for copepods between June and October, and euphausiids were taken only in May and November (Mitchell 1975). ~~In Some years of reduced predation on copepods by other predators, and thus greater abundance of this prey source, s~~Sei whales are reported in some years 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 (Jonsgård and Darling 1977).

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.

POPULATION SIZE

The total number of sei whales in the U.S. Atlantic EEZ is unknown. However, five 6 abundance estimates are available for portions of the sei whale habitat: from Nova Scotia during the 1970s, in the U.S. Atlantic EEZ during the springs of 1979-1981, and in the U.S. and Canadian Atlantic EEZ during the summers of 2002, 2004, and 2006 and 2011. The August 2004summer 2011 abundance estimate (of 386451467 (CV=0.627) is considered the best available for the Nova Scotia stock of sei whales. However, this estimate must be considered conservative in view ofbecause all of the known range of this stock e sei whale in the entire western North Atlanticwas not surveyed, and the because of uncertainties regarding population structure and whale movements between surveyed and unsurveyed areas. The abundance estimates of sei whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified sei whales to the total of positively identified fin whales and positively identified sei whales and the overall CV was adjusted for the variance of the estimated fraction.

Earlier abundance estimates

Please see appendix IV for earlier abundance estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An abundance estimate of 386 (CV=0.85) sei whales was derived 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 trackline in waters north of Maryland (38ºN)(Table 1; Palka 2006). There were 6,180 km of trackline within known sei whale habitat, from the 100-m depth contour on southern Georges Bank to the lower Bay of Fundy. The Scotian shelf south of Nova Scotia was not surveyed. 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 trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 207 (CV=0.62) sei whales was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 467 (CV=0.67) sei whales was generated from a shipboard and aerial survey conducted during June-August 2011. The aerial portion covered 6,850 km of tracklines that were over waters from north of New Jersey and shallower than the 100-m depth contour,depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimates of sei whales include a percentage of the estimate of animals identified as fin/sei whales (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified sei whales to the total of positively identified fin whales and positively identified sei whales; the CV of the abundance estimate includes the variance of the estimated fraction.

Table 1. Summary of recent abundance estimates for Nova Scotia sei whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Jul 2004	Gulf of Maine to lower Bay of Fundy	386	0.85
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	207	0.62
Jun-Aug 2011	North Carolina to lower Bay of Fundy	~~451~~467	0.6~~2~~7

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for the Nova Scotia stock sei whales is ~~386~~ ~~451~~467 (CV=0.~~85~~6~~2~~7). The minimum population estimate is ~~208~~279~~328~~.

Current Population Trend

A population trend analysis has not been done 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"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~208~~279~~328~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 ~~0.4~~0.6~~7~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period ~~2005~~ 2006 through ~~2009~~2010, the minimum annual rate of human-caused mortality and serious injury to sei whales was 1.2. This value includes incidental fishery interaction records, 0.6, and records of vessel collisions, 0.6 (Henry *et al.* ~~2011~~2012). Annual rates calculated from detected mortalities should not be considered an unbiased estimate of human-caused mortality, but they represent a definitive lower bound. Detections are haphazard, incomplete and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

Fishery-Related Serious Injury and Mortality

No confirmed fishery-related mortalities or serious injuries of sei whales have been reported in the NMFS Sea Sampling bycatch database. A review of the records of stranded, floating or injured sei whales for the period ~~2005~~

2006 through 2009 2010 on file at NMFS found 3 records with substantial evidence of fishery interactions causing serious injury or mortality (Table 2), which results in an annual rate of serious injury and mortality of 0.6 sei whales from fishery interactions.

Table 2. Confirmed human-caused mortality and serious injury records of Nova Scotian sei whales, 2005 - 2009.

Date[a]	Report Type[b]	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh inter	
04/17/06	mortality	Juvenile Male 10.9m	Baltimore, MD	P		Brought in on bow of ship, freshly dead; massive hemorrhaging on right side; large blood clot behind head; several broken ribs
09/16/06	serious injury	age & sex unknown	Jeffreys Ledge		P	Constricting wrap cutting into skin; no gear recovered
05/30/07	mortality	Adult Female 14.4m	off Deer Island, MA	P		Broken left flipper, 8 vertebral processes, and 4 ribs; right flipper sheared off; lower jaw dislocated; hemorrhaging and/or edema associated with lower jaw and left flipper region
04/09/08	serious injury	age & sex unknown	Great South Channel		P	Constricting wrap on fluke; skin sloughing; no gear recovered
06/29/08	mortality	age & sex unknown 15m (est)	Slacks Cove, New Brunswick		P	Extensive entanglement evident; no gear present
5/19/2009	mortality	Juvenile Male 12.7 m	off Rehobeth Beach, DE	P	-	Posterior portion of skull & right mandible fractured; hemorrhaging dorsal to left pectoral

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.
b. National guidelines for determining what constitutes a serious injury have not been finalized. Interim criteria as established by NERO/NMFS (Nelson et al. 2007) have been used here. Some assignments may change as new information becomes available and/or when national standards are established.

Table 2. Confirmed human-caused mortality and serious injury records of Nova Scotian sei whales *(Balaenoptera borealis)*, 2006 - 2010.

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship Strike	Entanglement/ Fish interaction	
-	-	-	-		-	-
-	-	-	-			-
-	-	-	-			-

4/17/2006	mortality	Juvenile Male 10.9m	Baltimore, MD	P		Brought in on bow of ship, freshly dead; massive hemorrhaging on right side; large blood clot behind head; several broken ribs
9/16/2006	serious injury	age & sex unknown	Jeffreys Ledge		P	Constricting wrap cutting into skin; no gear recovered
5/30/2007	mortality	Adult Female 14.4m	off Deer Island, MA	P		Broken left flipper, 8 vertebral processes, and 4 ribs; right flipper sheared off; lower jaw dislocated; hemorrhaging and/or edema associated with lower jaw and left flipper region
4/9/2008	serious injury	age & sex unknown	Great South Channel		P	Constricting wrap on fluke; skin sloughing; no gear recovered
6/29/2008	mortality	age & sex unknown 15m (est)	Slack's Cove, NB		P	Extensive entanglement evident; no gear present
5/19/2009	mortality	Juvenile Male 12.7 m	off Rehobeth Beach, DE	P		Posterior portion of skull & right mandible fractured; hemorrhaging dorsal to left pectoral

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

Other Mortality

For the period ~~2005~~ 2006 through ~~2009~~ 2010 files at NMFS included three records with substantial evidence of vessel collisions causing serious injury or mortality (Table 2), which results in an annual rate of serious injury and mortality of 0.6 sei whales from vessel collisions. Previous NMFS records of human-caused sei whale mortalities include one from 17 November 1994, when a sei whale carcass was observed on the bow of a container ship as it docked in Boston, Massachusetts, and one from 2 May 2001 when the carcass of a 13-m female sei whale slid off the bow of a ship arriving in New York harbor.

STATUS OF STOCK

This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the sei whale is listed as an endangered species under the ESA. A final recovery plan for the sei whale was published in 2011 (NMFS 2011). The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is not less than 10% of the calculated PBR, and, therefore, cannot be considered insignificant and approaching the ZMRG. 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 population trends for sei whales. ~~The total U.S. fishery-related mortality and serious injury for this stock derived from the available records is not less than 10% of the calculated PBR, and therefore cannot be considered insignificant and approaching the ZMRG. This is a strategic stock because the average annual human-related mortality and serious injury exceeds PBR, and because the sei whale is listed as an endangered species under the ESA.~~

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MINKE WHALE (*Balaenoptera acutorostrata acutorostrata*): Canadian East Coast Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Minke whales have a cosmopolitan distribution in temperate, ~~and~~ tropical, and high-latitude waters. In the North Atlantic, there are four recognized populations—Canadian East Coast, west Greenland, central North Atlantic, and northeastern North Atlantic (Donovan 1991). These divisions were defined by examining segregation by sex and length, catch distributions, sightings, marking data and pre-existing ICES boundaries. However, there were very few data from the Canadian East Coast population. Anderwald *et al*.~~,~~ (2011) found no evidence for geographic structure comparing these putative populations but did, using individual genotypes and likelihood assignment methods, identify two cryptic stocks distributed across the North Atlantic. Until better information is available, m~~M~~inke whales off the eastern coast of the United States are considered to be part of the Canadian East Coast stock, which inhabits the area from the western half of the Davis Strait (45ºW) to the Gulf of Mexico. ~~The relationship between this stock and the other three stocks is uncertain.~~ It is also uncertain if there are separate sub-stocks within the Canadian East Coast stock.

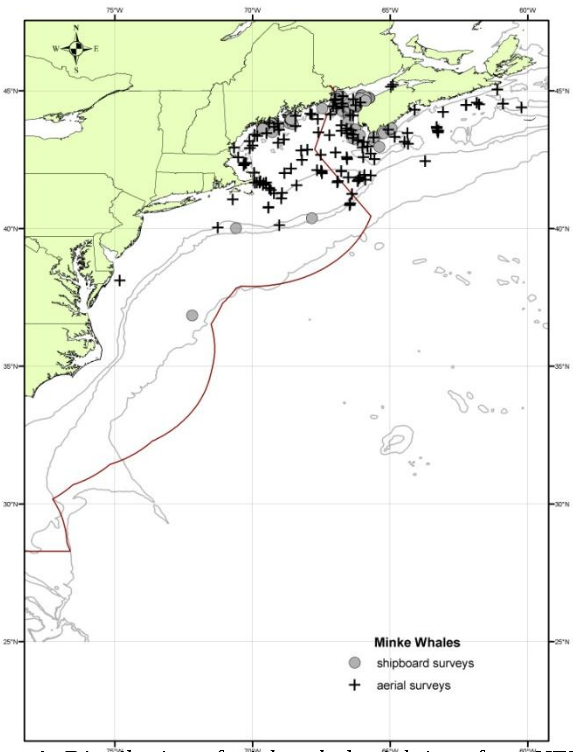

Figure 1. *Distribution of minke whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006~~ and~~, 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

The minke whale is common and widely distributed within the U.S. Atlantic Exclusive Economic Zone (EEZ) (CETAP 1982). There appears to be a strong seasonal component to minke whale distribution. Spring and summer are times of relatively widespread and common occurrence, and when the whales are most abundant in New England waters. In New England waters during fall there are fewer minke whales, while during winter the species appears to be largely absent. Like most other baleen whales, minke whales generally occupy the continental shelf proper, rather than the continental shelf-edge region. Records summarized by Mitchell (1991) hint at a possible winter distribution in the West Indies, and in the mid-ocean south and east of Bermuda. As with several other cetacean species, the possibility of a deep-ocean component to the distribution of minke whales exists but remains unconfirmed.

POPULATION SIZE

~~The total number of minke whales in the Canadian East Coast population is unknown. However, m~~Multiple estimates are available for portions of ~~the~~ minke whale habitat (see Appendix IV for details on these surveys and estimates). The best recent abundance estimate for this stock is 20,741 (CV=0.30) minke whales. This is the estimate derived from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007 and is considered best because, while it did not cover any U.S. waters, the survey covered more of the minke whale range than the other surveys reported here.~~the summed result of the 2011 US survey and the 2007 Canadian survey~~

7,8172,142 (CV=0.8029).8,987 (CV=0.32) (Table 2), which is the sum of the August 2006 U.S. survey (3,312 CV=0.74) and the July-August 2007 Canadian survey (5,675 CV=0.25).

Earlier estimates

For earlier abundance estimates please see Appendix IV.

Recent surveys and abundance estimates

An abundance estimate of 600 (CV=0.61) minke whales was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 6,180 km of trackline from the 100-m depth contour on southern Georges Bank to the lower Bay of Fundy. The Scotian Shelf south of Nova Scotia was not surveyed (Table 1; Palka 2006). Shipboard data were collected using the two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995), accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 3,312 (CV=0.74) minke whales was generated from an aerial survey conducted in August 2006 which surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.). The value of *g(0)* used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 20,741 (CV=0.30) 5,675 (95%CI=2,214-6,745) minke whales was generated from the Canadian Trans-North Atlantic Sighting Survey (TNASS) in July-August 2007. This survey covered from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. Estimates from this survey have not yet been corrected for availability and perception biases (Lawson and Gosselin 2009). The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (MCRDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (2007) analysis method (Lawson and Gosselin 2011).

An abundance estimate of 2,1427,817 (CV=0.8029) .minke whales was generated from a shipboard and aerial survey conducted during June--August 2011. The aerial portioned covered 6,850 km of tracklines that were over waters from Massachusetts to New Brunswick, Canada (waters north of New Jersey and shallower than the 100-m depth contour,depth contour through the US and Canadian Gulf of MaineUS and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy). -The shipboard portioned covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the US EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of abundance estimates for the Canadian east coast stock of minke whales with month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation. (CV).

Month/Year	Area	N_{best}	CV
Jun-Jul 2004	Gulf of Maine to lower Bay of Fundy	600	0.61
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	3,312	0.74

Table 1. Summary of abundance estimates for the Canadian east coast stock of minke whales with 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-Aug 2007	N. Labrador to Scotian Shelf	20,741 5,675	0.21 0.270.30
Aug 2006 + Jul-Aug 2007	S. Gulf of Maine to N. Labrador (COMBINED)	8,987	0.32
Jul-Aug 2011	North Carolina to lower Bay of Fundy	2,1427,817	0.800.29
Jul-Aug 2011 + Jul-Aug 2007	North Carolina to N. Labrador (COMBINED)	7,817	0.29

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 minke whales is 20,7418,9877,8172,142 animals (CV=0.39328300). The minimum population estimate for the Canadian East Coast minke whale is 6,9096,1301,44716,199 animals.

Current Population Trend

A population trend analysis for this species has not been conducted.

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 are that females mature between 6 and 8 years of age, and pregnancy rates are approximately 0.86 to 0.93. Based on these parameters, the calving interval is between 1 and 2 years. Calves are probably born during October to March after 10 to 11 months gestation and nursing lasts for less than 6 months. Maximum ages are not known, but for Southern Hemisphere minke whales maximum age appears to be about 50 years (IWC 1991; Katona *et al.* 1993).

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"recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 6,9096,1301,44716,199. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery"recovery factor, which accounts for endangered, depleted, or 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 Canadian east coast minke whale is 696114162.

ANNUAL HUMAN-CAUSED MORTALITY AND INJURY

During 2005 2006 to 20092010, the total average annual minimum detected average human-caused mortality and serious injury was 5.,9 60 minke whales per year (3.52.6 (0.344637) minke whales per year from observed U.S. fisheries, 0.81.0 minke whales per year (unknown CV) from U.S. fisheries using strandings and entanglement data, 21.2 0 (unknown CV) from Canadian fisheries using strandings and entanglement data, and 0.4 per year from U.S. ship strikes (Henry *et al.* 20112012)).

Data to estimate the mortality and serious injury of minke whales come from the Northeast Fisheries Science Center Observer Program, the At-Sea Monitor Program, and from records of strandings and entanglements in U.S. and Canadian waters. For the purposes of this report, only those unobserved strandings and entanglement records considered confirmed human-caused mortalities or serious injuries are shown in Table 2, while mortalities and serious injuries recorded by the Observer or At-Sea Monitor Programs are recorded in Table 3.

Detected mortalities in the strandings and entanglement data should not be considered an unbiased representation of human-caused mortality. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate which is almost certainly biased low.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

~~Little information is available about fishery interactions that took place before the 1990s. Read (1994) reported that a minke whale was found dead in a Rhode Island fish trap in 1976. A minke whale was caught and released alive in the Japanese tuna longline fishery in 3,000 m of water, south of Lydonia Canyon on Georges Bank, in September 1986 (Waring *et al.* 1990).~~

~~Two minke whales were observed taken in the Northeast sink gillnet fishery. The take in July 1991, south of Penobscot Bay, Maine, was a mortality, and the take in October 1992, off the coast of New Hampshire near Jeffreys Ledge, was released alive.~~

~~A minke whale was trapped and released alive from a herring weir off northern Maine in 1990.~~

~~Four minke whale mortalities were observed in the Atlantic pelagic drift gillnet fishery during 1995; the fishery closed in 1998.~~

~~One minke whale was reported caught in an Atlantic tuna purse seine off Stellwagen Bank in 1991 (D. Beach, NMFS NE Regional Office, pers. comm.) and another in 1996. The minke caught during 1991 was released uninjured after a crew member cut the rope wrapped around the tail. The minke whale caught during 1996 escaped by diving beneath the net.~~

~~One minke whale, reported in the strandings and entanglement database, was taken in a 6-inch gill net on 24 June 1998 off Long Island, New York. This take was assigned to the mid-Atlantic gillnet fishery. No minke whales have been taken in this fishery during observed trips in 1993 to 2009.~~

~~The strandings and entanglement database, maintained by the New England Aquarium and the Northeast Regional Office/NMFS, includes 36 records of minke whales within U.S. waters for 1975-1992. The gear includes unspecified fishing nets, unspecified cables or lines, fish traps, weirs, seines, gillnets, and lobster gear. One confirmed entanglement was an immature female minke whale, entangled with line around the tail stock, which came ashore on the Jacksonville, Florida jetty on 31 January 1990 (R. Bonde, USFWS, Gainesville, FL, pers. comm.).~~ For more details on the historical fishery interactions prior to 1999, see Waring *et al.* (2007).

~~The strandings and entanglement database reported 7 minke whale mortalities and serious injuries that were attributed to the Northeast/Mid-Atlantic Lobster Trap/Pot fishery during 1990 to 1994; 1 in 1990 (possible serious injury), 2 in 1991 (1 mortality and 1 serious injury), 2 in 1992 (both mortalities), 1 in 1993 (serious injury) and 1 in 1994 (mortality) (1997 List of Fisheries 62 FR33, 2 January 1997). The one confirmed minke whale mortality during 1995 was attributed to the lobster fishery. No confirmed mortalities or serious injuries of minke whales occurred in 1996. From the four confirmed 1997 records, one minke whale mortality was attributed to the lobster trap fishery.~~ In 2002, one minke whale mortality and one live release were attributed to the lobster trap fishery~~this fishery~~. The 28 June 2003 mortality, while wrapped in lobster gear, cannot be confirmed to have become entangled in the area, and so is not attributed to the fishery. Annual mortalities due to the Northeast/~~Mid-Atlantic~~mid-Atlantic Lobster Trap/Pot fishery, as determined from strandings and entanglement records that have been audited, were 1 in 1991, 2 in 1992, 1 in 1994, 1 in 1995, 0 in 1996, 1 in 1997, 0 in 1998 to 2001, 1 in 2002, and 0 in 2003 through ~~2009~~2010.

U.S.

Northeast Bottom Trawl

The fishery is active in New England waters in all seasons. Detailed fishery information is reported in Appendix III. One freshly dead minke whale was caught in 2004 on the northeastern tip of Georges Bank in US waters. Two dead minkes were reported by observers in 2008. Fisheries observer data from the years 2005 through 2009 were pooled and bycatch rates for minke whales were estimated using a stratified ratio-estimator. Estimated bycatch rates from the pooled fisheries observer data were expanded by annual (20065-20109) fisheries data collected from mandatory vessel trip reports. The estimated annual mortality (CV in parentheses) attributed to this fishery was 4.78 (0.75) for 2005, 3.71 (0.73) for 2006, 3.28 (0.72) for 2007, 2.86 (0.73) for 2008, 2.86 (0.75) for 2009 and 0 for 2010. Annual average estimated minke whale mortality and serious injury from the Northeast bottom trawl fishery during 2005 2006 to 2009 2010 was 3.52.6 (CV=0.344637)(Table 3).

Pelagic Longline

In 2010, a minke whale was caught but released alive (no serious injury) in the pelagic longline fishery, South Atlantic Bight fishing area (Garrison and Stokes 2012).

Unknown Fisheries

The audited NE Regional Office/NMFS entanglement/stranding database contains records of minke whales, of which the confirmed mortalities and serious injuries from the last five years are reported in Table 2. Mortalities (and serious injuries) that were likely a result of a U.S. fishery interaction with an unknown fishery include 3 (0) in 1997, 3 (0) in 1999, 1 (1) in 2000, 2 (0) in 2001, 1 (0) in 2002, 5 (0) in 2003, 2 (0) in 2004, 0 (0) in 2005, 0 (0) in 2006, 1 (1) in 2007, 1 (0) in 2008, and 0 (1) in 2009, and 02 (-13) in 2010 (Table 2). During 2005 2006 to 20092010, as determined from strandings and entanglement records, the minimum detected average annual mortality and serious injury is 0.81.0 minke whales per year in unknown U.S. fisheries (Table 2).

CANADA

Read (1994) reported interactions between minke whales and gillnets in Newfoundland and Labrador, in cod traps in Newfoundland, and in herring weirs in the Bay of Fundy. Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in Canadian waters, on between 25% and 40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. During 1991 through 1996, no minke whales were observed taken.

Herring Weirs

During 1980 to 1990, 15 of 17 minke whales were released alive from herring weirs in the Bay of Fundy. During January 1991 to September 2002, 26 minke whales were trapped in herring weirs in the Bay of Fundy. Of these 26, 1 died (H. Koopman, pers. comm.) and several (number unknown) were released alive and unharmed (A. Westgate, pers. comm.). Four minkes were reported released alive from Gran Manan herring weirs in 2009 (H. Koopman pers. comm.).

Other Fisheries

Six minke whales were reported entangled during 1989 in the groundfish gillnet fishery in Newfoundland and Labrador (Read 1994). One of these animals escaped and was still towing gear, the remaining five animals died.

Salmon gillnets in Canada, now no longer used, had taken a few minke whales. In Newfoundland in 1979, one minke whale died in a salmon net. In Newfoundland and Labrador, between 1979 and 1990, it was estimated that 15% of the Canadian minke whale takes were in salmon gillnets. A total of 124 minke whale interactions were documented in cod traps, groundfish gillnets, salmon gillnets, other gillnets, and other traps. The salmon gillnet fishery ended in 1993 as a result of an agreement between the fishermen and North Atlantic Salmon Fund (Read 1994).

Five minke whales were entrapped and died in Newfoundland cod traps during 1989. The cod trap fishery closed in Newfoundland in 1993 due to the depleted groundfish resources (Read 1994).

In 2004, two minke whales were reported dead in entangled fishing gear off of Newfoundland and Labrador, one in a blackback flounder net, and one in crab gear (Ledwell and Huntington 2004). Only the flounder net animal had enough information to include it as a human-caused mortality. In 2005, four minke whales were reported entangled in fishing gear in Newfoundland and Labrador. Two (entangled in salmon net and mackerel trap gear) were released alive and two (involved with whelk pot and toad crab pot fisheries) were dead (Ledwell and Huntington 2006). The whelk pot mortality could not be conclusively attributed to human causes. In 2006, one minke whale was reported dead in a mackerel trap off of Newfoundland (Ledwell and Huntington 2007). In 2007, four minke whales in Newfoundland and Labrador were reported entangled, but released alive (Ledwell and

Huntington 2008). In 2008, four minkes were reported entangled in Newfoundland and Labrador. Two of these were dead and two were released alive, though one of the live releases was listed as ""condition uncertain" (Ledwell and Huntington 2009). In 2008, one minke was reported dead in an unknown fishery off of New Brunswick. In 2009, one minke whale was determined to have been seriously injured off of Quebec. In 2010, a minke whale was released alive from a mackerel seine in La Poile Bay, Newfoundland (Ledwell and Huntington 2011). Mortalities (and serious injuries) that were likely a result of an interaction with an unknown Canadian fishery include 1(0) in 2005, 1(0) in 2006, 0(0) in 2007, 3(0) in 2008, and 0 (1) in 2009, and 4 (1) in 2010. During 2005 2006 to 20092010, as determined from Canadian strandings and entanglement records, the minimum detected average annual mortality and serious injury was 21.2 0 minke whales per year in fisheries (Table 2).

Table 2. Confirmed U.S. and Canadian human-caused mortality and serious injury records of Canadian East Coast stock of minke whales, January 2005 through December 2009.

Date[a]	Report Type[b]	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entang./ Fsh. Inter.	
5/23/2005	mortality	Juvenile Male 5.9m	Port Elizabeth, NJ	P	-	Ribs shattered; liver ruptured; evidence of internal hemorrhaging
08/24/2005[c]	mortality	age & sex unknown	Bridgeport, New World Island, Newfoundland	-	P	Constricting gear through mouth with flipper and tail wraps; toad crab pots
09/22/2006[c]	mortality	age & sex unknown	Woods Cove, Great Northern Peninsula, Newfoundland	-	P	Anchored by tail in doorways of the gear; mackerel trap
7/16/2007	serious injury	age & sex unknown 10m (est)	Trescott, ME	-	P	Wrapped in gear and anchored; no gear recovered
8/5/2007	mortality	Juvenile Female 4.3m	Cape Cod Bay, MA	-	P	Chronic entanglement with severe emaciation and dehydration and loss of protein; line lacerated blubber layer across back and at flipper insertions; severe hemorrhage and necrosis of blubber at gear entanglement points; gear consists of 11/16" diameter floating rope

~~6/14/2008~~	~~mortality~~	~~Juvenile Female 4.7m~~	~~Orleans, MA~~	~~-~~	~~P~~	~~Braided line impressions wrapped the body in 3 places and left a deep, hemorrhaged laceration across the rostrum and blowholes; hemorrhaged abrasions present on roof of mouth; wet, blood-filled lungs indicate drowning; no gear present~~
~~7/23/2008~~	~~mortality~~	~~age & sex unknown 7m (est)~~	~~Kelligrews, Newfoundland~~	~~-~~	~~P~~	~~Constricting wraps of gear on caudal peduncle; 5/8" polypropylene rope~~
~~7/26/2008~~	~~mortality~~	~~age & sex unknown~~	~~Conception Bay, Newfoundland~~	~~-~~	~~P~~	~~Constricting wraps of gear through mouth and around tail; blackback flounder nets~~
~~8/25/2008~~	~~mortality~~	~~age & sex unknown 8m (est)~~	~~off Richibucto Cape, New Brunswick~~	~~-~~	~~P~~	~~Evidence of constricting body wraps; gear not recovered~~
~~5/20/2009~~	~~mortality~~	~~Adult sex unknown 8m (est)~~	~~off Point Pleasant, NJ~~	~~P~~	~~-~~	~~Large hemorrhage at right pectoral~~
~~6/3/2009~~	~~serious injury~~	~~age & sex unknown~~	~~off Tadoussac, Quebec~~	~~-~~	~~P~~	~~Free-swimming with tight rostrum wrap; no gear recovered~~
~~8/11/2009~~	~~serious injury~~	~~age & sex unknown~~	~~off Plymouth, MA~~	~~-~~	~~P~~	~~Constricting wrap on rostrum & poor skin condition; no gear recovered~~

			~~ship strike~~	**~~entanglement~~**	
~~5-year totals~~	**~~US waters~~**	**~~serious injury~~**	**~~0~~**	**~~2~~**	
		~~mortality~~	**~~2~~**	**~~2~~**	
	~~Canadian waters~~	**~~serious injury~~**	**~~0~~**	**~~1~~**	
		~~mortality~~	**~~0~~**	**~~5~~**	

~~a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.~~

~~b. National guidelines for determining what constitutes a serious injury have not been finalized. Interim criteria as established by NERO/NMFS (Henry *et al.* 2011) have been used here. Some assignments may change as new information becomes available and/or when national standards are established.~~

~~c.~~a. ~~Additional record which was not included in previous reports.~~

Table 2. Confirmed human-caused mortality and serious injury records of Canadian East Coast minke whales *(Balaenoptera acutorostrata)*, 2006 - 2010.

Date[a]	Report Type	Age, Sex, Length	Location[a]	Assigned Cause: P=primary, S=secondary		Notes/Observations
				Ship strike	Entanglement/ Fishery interaction	
09/22/06[b]	mortality	age & sex unknown	Woods Cove, Great Northern Peninsula, NL		P	Anchored by tail in doorways of the gear; mackerel trap
7/16/2007	serious injury	age & sex unknown 10m (est)	Trescott, ME		P	Wrapped in gear and anchored; no gear recovered
8/5/2007	mortality	Juvenile Female 4.3m	Cape Cod Bay, MA		P	Chronic entanglement with severe emaciation and dehydration and loss of protein; line lacerated blubber layer across back and at flipper insertions; severe hemorrhage and necrosis of blubber at gear entanglement points; gear consists of 11/16" diameter floating rope
6/14/2008	mortality	Juvenile Female 4.7m	Orleans, MA		P	Braided line impressions wrapped the body in 3 places and left a deep, hemorrhaged laceration across the rostrum and blowholes; hemorrhaged abrasions present on roof of mouth; wet, blood-filled lungs indicate drowning; no gear present

7/23/2008	mortality	age & sex unknown 7m (est)	Kelligrews, NL	-	P	Constricting wraps of gear on caudal peduncle; 5/8" polypropylene rope
7/26/2008	mortality	age & sex unknown	Conception Bay, NL	-	P	Constricting wraps of gear through mouth and around tail; blackback flounder nets
8/25/2008	mortality	age & sex unknown 8m (est)	off Richibucto Cape, NB	-	P	Evidence of constricting body wraps; gear not recovered
5/20/2009	mortality	Adult sex unknown 8m (est)	off Point Pleasant, NJ	P	-	Large hemorrhage at right pectoral
6/3/2009	serious injury	age & sex unknown	off Tadoussac, Quebec	-	P	Free-swimming with tight rostrum wrap; no gear recovered
8/11/2009	serious injury	age & sex unknown	off Plymouth, MA	-	P	Constricting wrap on rostrum & poor skin condition; no gear recovered
7/9/2010	mortality	Juvenile Male 5.7m	Fire Island, NY	P	-	3-4 large dorsal lacerations associated with fractured ribs
8/21/2010	serious injury	Adult sex unknown	Plymouth Harbor, MA	-	P	Embedded rostrum wrap; no gear recovered

a. The date sighted and location provided in the table are not necessarily when or where the serious injury or mortality occurred; rather, this information indicates when and where the whale was first reported beached, entangled, or injured.

b. Additional record which was not included in previous reports.

Table 3. Summary of the incidental mortality of Canadian East Coast stock of minke whales (*Balaenoptera acutorostrata acutorostrata*) by commercial fishery including the years sampled (Years), 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 [a]	Years	Data Type [b]	Observer ~~Coverage~~ [c] Coverage [b]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality

Northeast Bottom Trawl~~d~~	~~05~~06-~~09~~10	Obs. Data Dealer Data VTR Data	~~.12,~~ .06, .06, .08, .09, .16	0, 0, 0, 0, 0	~~0,~~ 0, 0, 2, 0, 0	0, 0, 0, 0, 0	~~4.8,~~ 3.7, 3.3, 2.9, 2.9, 0	~~4.8,~~ 3.7, 3.3, 2.9, 2.9, 0	~~.75,~~ .73, .72, .73, .75, 0	~~3.5~~2.6 (.~~34~~46~~37~~)
TOTAL										~~3.5~~2.6 (.~~34~~463~~7~~)

a.
Bycatch rates were estimated from fisheries observer data pooled over years 2005-2009. A new five year time period will begin in 2010. Fisheries observer data from the years 2010-2014 will be pooled to estimate bycatch rates for minke whales for the same five year time period. No takes of minke whales were observed or monitored in 2010. As a result the estimated mortality is zero.
~~Fisheries observer data from the years 2005 through 2009 were pooled and bycatch rates for minke whales were estimated using a stratified ratio-estimator. Estimated bycatch rates from the pooled fisheries observer data were expanded by annual (2005-2009) fisheries data collected from mandatory vessel trip reports .~~b.
Total observer coverage reported for bottom trawl gear in the year 2010 includes samples collected from traditional fisheries observers, ~~Northeast Fisheries Observer Program (NEFOP)~~in addition to at-sea fishery monitors (both programs currently run through the Northeast Fisheries Observer Program (NEFOP)~~through the Northeast Fisheries Observer Program (NEFOP)~~. In the Northeast region, 437 and 658 trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 trips were sampled by observers and monitors, respectively.

Other Mortality

Minke whales have been and continue to be hunted in the North Atlantic. From the Canadian East Coast population, documented whaling occurred from 1948 to 1972 with a total kill of 1,103 animals (IWC 1992). Animals from other North Atlantic minke populations are presently still being harvested.

U.S.

Minke whales inhabit coastal waters during much of the year and are thus subject to collision with vessels. According to the NMFS/NER marine mammal entanglement and stranding database, on 7 July 1974, a necropsy of a minke whale suggested a vessel collision; on 15 March 1992, a juvenile female minke whale with propeller scars was found floating east of the St. Johns Channel entrance (R. Bonde, USFWS, Gainesville, FL, pers. comm.); and on 15 July 1996 the captain of a vessel reported hitting a minke whale offshore of Massachusetts. After reviewing this record, it was concluded the animal struck was not a serious injury or mortality. On 12 December 1998, a minke whale was struck and presumed killed by a whale-watching vessel in Cape Cod Bay off Massachusetts.

During 1999 to 2003, no minke whale was confirmed struck by a ship. During 2004 and 2005, one minke whale mortality was attributed to ship strike in each year (Table 2). During 2006 to 2008, no minke whale was confirmed struck by a ship. During 2009, one minke whale was confirmed dead due to a ship strike off ~~of~~ New Jersey and in 2010 a juvenile male minke was discovered killed by ship strike off Fire Island, New York. Thus, during ~~2005~~ 2006 to ~~2009~~2010, as determined from stranding and entanglement records, the minimum detected annual average was 0.4 minke whales per year struck by ships.

In October 2003, an Unusual Mortality Event was declared involving minke whales and harbor seals along the coast of Maine; since then, the number of minke whale stranding reports has returned to normal. Stranding mortalities and serious injuries that have been determined to be human-caused are included in Table 2 (Henry *et al.* ~~2011~~2012).

On 11 October 2009, the NOAA research vessel FSV Delaware II captured a minke whale during mid-water trawling operations associated with the 2009 Atlantic Herring Acoustics survey. Although brought on deck, the animal was released alive and appeared to exhibit healthy behavior upon release.

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded on the coast of Nova Scotia between 1991 and 1996 (Hooker *et al.* 1997). Researchers with the Department of Fisheries and Oceans, Canada documented strandings on the beaches of Sable Island (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. Lucas and Hooker (2000) reported 4 minke whales stranded on Sable Island between 1970 and 1998, 1 in spring 1982, 1 in January 1992, and a mother/calf in December 1998. On the mainland of Nova Scotia, a total of 7 minke whales stranded during 1991 to 1996. The 1996 stranded minke whale was released alive off Cape Breton on the Atlantic Ocean side, the rest were found dead. All the minke whales stranded between July and October. One was from the Atlantic Ocean side of Cape Breton, 1 from Minas Basin, 1 was at an unknown location, and the rest stranded in the vicinity of Halifax, Nova Scotia. It is unknown how many of the strandings resulted from fishery interactions.

Whales and dolphins stranded between 1997 and 2009 on the coast of Nova Scotia as recorded by the Marine Animal Response Society (MARS) and the Nova Scotia Stranding Network are as follows: 4 minke whales stranded in 1997, 0 documented strandings in 1998 to 2000, 1 in September 2001, 4 in 2002, 2 in 2003, 0 in 2004, 3 in 2005, 8 in 2006, 1 in 2007, 4 (including the entangled animal listed in Table 2) in 2008, and 5 in 2009 (including one minke released alive from a weir).

The Whale Release and Strandings program has reported ~~ten~~ 8 minke whale stranding mortalities in Newfoundland and Labrador between ~~2005~~ 2006 and ~~2009~~2010; ~~3 in 2005,~~ 1 in 2006, 2 in 2007, 3 in 2008, 1 in 2009 and 1 in 2010. ~~Four~~ Three of these records are included in Table 2 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010, 2011).

STATUS OF STOCK

This is not a strategic stock because estimated human-related mortality and serious injury does not exceed PBR, and the minke whale is not listed as a threatened or endangered species under the Endangered Species Act (ESA)~~ESA~~. The total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate.

The status of minke whales, relative to OSP, in the U.S. Atlantic EEZ is unknown.
~~The minke whale is not listed as endangered under the Endangered Species Act (ESA). The total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because estimated human-related mortality and serious injury does not exceed PBR and the minke whale is not listed as a threatened or endangered species under the ESA.~~

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

The distribution of the sperm whale in the U.S. Exclusive Economic Zone (EEZ) occurs on the continental shelf edge, over the continental slope, and into mid-ocean regions (Figure 1). Waring *et al.* (1993, 2001) suggest that this offshore distribution is more commonly associated with the Gulf Stream edge and other features. However, the sperm whales that occur in the eastern U.S. Atlantic EEZ likely represent only a fraction of the total stock. The nature of linkages of the U.S. habitat with those to the south, north, and offshore is unknown. Historical whaling records compiled by Schmidly (1981) suggested an offshore distribution off the southeast U.S., over the Blake Plateau, and into deep ocean waters. In the southeast Caribbean, both large and small adults, as well as calves and juveniles of different sizes are reported (Watkins *et al.* 1985). Whether the northwestern Atlantic population is discrete from northeastern Atlantic is currently unresolved. The International Whaling Commission recognizes one stock for the North Atlantic. Based on reviews of many types of stock studies, (i.e., tagging, genetics, catch data, mark-recapture, biochemical markers, etc.) Reeves and Whitehead (1997) and Dufault *et al.* (1999) suggested that sperm whale populations have no clear geographic structure. ~~Recent o~~Ocean wide genetic studies (Lyrholm and Gyllensten 1998; Lyrholm *et al.* 1999) indicated low genetic diversity, but strong differentiation between potential social (matrilineally related) groups. Further, Englehaupt et al. (2009) found no differentiation for mtDNA between samples from the western North Atlantic and from the North Sea~~,~~ but significant differentiation between samples from the Gulf of Mexico and from the Atlantic Ocean just outside the Gulf of Mexico. ~~Further, the~~These ocean-wide findings, combined with observations from other studies, indicate stable social groups, site fidelity, and latitudinal range limitations in groups of females and juveniles (Whitehead 2002). In contrast, males migrate to polar regions to feed and ~~return to more tropical waters~~move among populations to breed (Whitehead 2002, Englehaupt 2009). 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~~ 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).

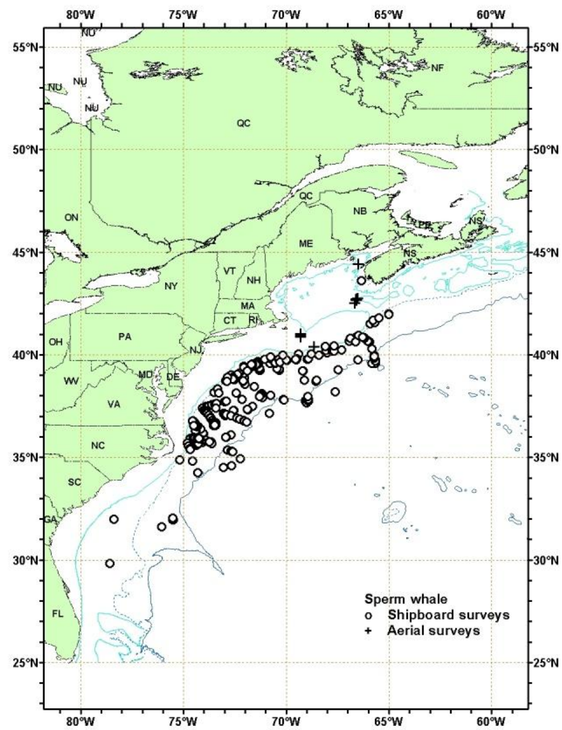

Figure 1. *Distribution of sperm whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998, 1999, 2002, 2004 and 2006. Isobaths are the 100m, 1,000m, and 4,000m depth contours.*

Geographic distribution of sperm whales may be linked to their social structure and their low reproductive rate and both of these factors have management implications. Several basic groupings or social units are generally recognized — nursery schools, harem or mixed schools, juvenile or immature schools, bachelor schools, bull schools or pairs, and solitary bulls (Best 1979; Whitehead *et al.* 1991; Christal *et al.* 1998). These groupings have a distinct geographical distribution, with females and juveniles generally based in tropical and subtropical waters, and males more wide-ranging and occurring in higher latitudes. Male sperm whales are present off and sometimes on the continental shelf along the entire east coast of Canada south of Hudson Strait, whereas, females rarely migrate north of the southern limit of the Canadian EEZ (Reeves and Whitehead 1997; Whitehead 2002). Off the northeast U.S., CETAP and ~~NMFS/~~NEFSC sightings in shelf-edge and off-shelf waters included many social groups with calves/juveniles (CETAP 1982; Waring *et al.* 1992, 1993). The basic social unit of the sperm whale appears to be the mixed school of adult females plus their calves and some juveniles of both sexes, normally numbering 20-40 animals in all. There is evidence that some social bonds persist for many years (Christal *et al.* 1998).

POPULATION SIZE

~~Total numbers of sperm whales off the U.S. or Canadian Atlantic coast are unknown, although s~~Several estimates from selected regions of ~~the~~ sperm whale habitat ~~do~~ exist for select time periods~~,~~; however, at present, there is no reliable estimate of total sperm whale abundance in the western North Atlantic. Sightings ~~were~~ have been almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best recent abundance estimate for sperm whales is the ~~the~~ result of the 2011 survey ~~1,982~~1,584 (CV=0.~~36~~40). ~~sum of the estimates from the two 2004 U.S. Atlantic surveys, 4,804 (CV=0.38), where the estimate from the northern U.S. Atlantic is 2,607 (CV=0.57), and from the southern U.S. Atlantic is 2,197 (CV=0.47). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.~~ Because all the sperm whale estimates presented here were not corrected for dive-time, they are likely downwardly biased and an underestimate of actual abundance. The average dive-time of sperm whales is approximately 30-60 min (Whitehead *et al.* 1991; Watkins *et al.* 1993; Amano and Yoshioka 2003; Watwood *et al.* 2006), therefore, the proportion of time that they are at the surface and available to visual observers is assumed to be low.

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

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. Due to changes in survey methodology these data should not be used to make comparisons to more current estimates. ~~An abundance of 219 (CV=0.36) sperm whales was estimated from an aerial survey program conducted from 1978 to 1982 on the continental shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance of 338 (CV=0.31) sperm whales was estimated from an August 1990 shipboard line transect sighting survey, conducted principally along the Gulf Stream north wall between Cape Hatteras and Georges Bank (NMFS 1990; Waring *et al.* 1992). An abundance of 736 (CV=0.33) sperm whales was estimated from a June and July 1991 shipboard line- transect sighting survey conducted primarily between the 200 and 2,000-m isobaths from Cape Hatteras to Georges Bank (Waring *et al.* 1992; Waring 1998). An abundance of 705 (CV=0.66) and 337 (CV=0.50) sperm whales was estimated from line transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11, respectively (NMFS 1991). An abundance of 116 (CV=0.40) sperm whales was estimated from a June and July 1993 shipboard line-transect sighting survey conducted principally between the 200 and 2,000-m isobaths from the southern edge of Georges Bank, across the Northeast Channel to the southeastern edge of the Scotian Shelf (NMFS 1993). An abundance of 623 (CV=0.52) sperm whales was estimated from an August 1994 shipboard line transect survey conducted within a Gulf Stream warm-core ring located in continental slope waters southeast of Georges Bank (NMFS 1994). An abundance of 2,698 (CV=0.67) sperm whales was estimated from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Palka 1996). An abundance of 2,848 (CV=0.49) sperm whales was estimated from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38ºN). 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 (38ºN) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

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

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38ºN) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and there were a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were analyzed to correct for visibility bias (*g(0)*) and group-size bias employing line line-transect distance analysis and the direct duplicate estimator (Palka 1995; Buckland *et al.*, 2001). The resulting abundance estimate for sperm whales between Florida and Maryland was 2,197 (CV=0.47) (Table 1).

An abundance estimate of 1,982 (CV=0.36) sperm whales was generated from a shipboard and aerial survey conducted during Jun--Aug 2011. The aerial portioned covered 6850 km of tracklines that were over waters from Massachusetts to New Brunswick, Canada (waters north of New Jersey and shallower than the 100-m depth contour, through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy). The shipboard portioned covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous-team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida,). The abundance estimates from this southern survey are being calculated and are not available at this time."

Table 1. Summary of abundance estimates for the western North Atlantic sperm whale. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to the Bay of Fundy	2,607	0.57
Jun-Aug 2004	Florida to Maryland	2,197	0.47
Jun-Aug 2004	Bay of Fundy to Florida (COMBINED)	4,804	0.38
Jul-Aug 2011	North Carolina to lower Bay of Fundy	1,9821,584	0.3640

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 ~~1,982~~ 1,584 (CV=0.~~36~~40)~~4,804 (CV=0.38)~~. The minimum population estimate for the western North Atlantic sperm whale is ~~3,539~~~~1,481~~1,142.

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"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~3,539~~~~1,481~~1,142. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.10 because the sperm whale is listed as endangered under the Endangered Species Act (ESA). PBR for the western North Atlantic sperm whale is ~~7.1~~~~3.0~~2.3.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

During 2006-2010~~2001-2005~~, annual average human caused mortality was ~~zero~~0.~~2~~6 due to one report of a ship strike mortality in 2006 and reports of one sperm whale mortality in 2009 and one in 2010 in the Canadian Labrador halibut longline fishery (J. Lawson, DFO, pers. comm.). ~~0.2 sperm whales per year (CV=unknown).~~ Sperm whales have not been documented as bycatch in the observed U.S. Atlantic commercial fisheries.
~~This is derived from two components: 0 sperm whales per year (CV=unknown) from U.S. fisheries using observer data and 0.2 sperm whales per year from ship strikes.~~

Fishery Information

Detailed fishery information is reported in Appendix III.

~~**Earlier Interactions**~~

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

Other Mortality

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

During 1994-2005~~1994-2000~~, ~~eighteen~~ thirty-three sperm whale strandings have been documented along the U.S. Atlantic coast and in Puerto Rico and the EEZ ~~U.S. Atlantic coast between Maine and Miami, Florida~~ (NMFS unpublished data). One 1998 ~~and~~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 2001, the U.S. Navy reported a ship strike in EEZ waters. 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 2006-2010, ~~2001 to 2005, fifteen~~ ~~ten~~11 sperm whale strandings were documented along the U.S. Atlantic coast within~~and~~ ~~and in Puerto Rico and~~ the EEZ according to the NER and SER strandings databases (Table 2). None of the strandings ~~showed signs~~were classified as human interactions. ~~Except for the sperm whale struck by a naval vessel in the EEZ in 2001, there were no confirmed documented signs of human interactions on the other animals.~~

~~Table 2. Sperm Whale (*Physeter macrocephalus*) reported strandings along the U.S. Atlantic coast, 2001-2005.~~

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

~~[1] U.S. Navy reported ship strike~~

Table 2: Sperm whale (*Physeter macrocephalus*) reported strandings along the U.S. and Canada Atlantic coast 2006-2010

Stranding State	2006	2007	2008	2009	2010	**Total**
Newfoundland/Labrador[a]	3	4	1	1	0	**9**
New York	0	1	0	1	0	**2**
North Carolina	1	0	1	0	1	**3**
Florida	1	0	1	0	1[b]	**3**
EEZ	2	1	0	0	0	**3**
TOTAL U.S.	**4**	**2**	**2**	**1**	**2**	**11**

a. Data provided by Whale Release and Strandings, Tangly Whales Inc. Newfoundland, Canada
b. Young sperm whale swimming in the Miami Beach Marina eluded euthanasia attempts.

In eastern Canada, 6 dead strandings were reported in Newfoundland/Labrador in 1987-2005; 20 dead strandings along Nova Scotia in 1988-2005; 9 dead strandings on Prince Edward Island in 1988-2005; 2 dead strandings in Quebec in 1992; 5 dead strandings in New Brunswick in 2005; and 13 animals in 8 stranding events on

Sable Island, Nova Scotia in 1970-1998 (Reeves and Whitehead 1997; Hooker *et al.* 1997; Lucas and Hooker 2000). Sex was recorded for 11 of the 13 Sable island animals, and all were male, which is consistent with sperm whale distribution patterns (Lucas and Hooker 2000).

Mass strandings have been reported in many oceanic regions (Rice et al. 1986; Kompanje and Reumer 1995; Evans et al. 2002; Fujiwara et al. 2007; Pierce et al. 2007; Mazzariol et al. 2011). ~~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, changes in geomagnetic field, solar cycles, ship strikes, global changes in water temperature and prey distribution, and pollution) have been suggested (Kirschvink et al. 1986; Brabyn and Frew 1994; Holsbeek *et al.* 1999; Mazzariol et al. 2011).

Ship strikes are another source of human- induced mortality (McGillivary et al. 2009; Carrillo and Ritter 2010). 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; in 2001 the U.S. Navy reported a ship strike within the EEZ (NMFS, unpublished data). In 2006, a sperm whale was found dead from ship strike wounds off Portland, Maine. In spring, the Block Canyon region is part of a major pathway for sperm whales entering southern New England continental shelf waters in pursuit of migrating squid (CETAP 1982; Scott and Sadove 1997).

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

Using stranding and entanglement data, during ~~2001~~2006-~~2005~~2010, one sperm whale was confirmed struck by a ship, thus, there is an annual average of 0.2 sperm whales per year struck by ships. ~~No sperm whale stranding mortalitiesduring this period were confirmed fishery interactions.~~

STATUS OF STOCK

This is a strategic stock because the species is listed as endangered under the ESA. Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR~~,~~ and, therefore, can be considered to be insignificant and approaching a zero mortality and serious injury rate. The status of this stock relative to OSP in U.S. Atlantic EEZ is unknown~~, but the species is listed as endangered under the ESA~~. There are insufficient data to determine population trends. The current stock abundance estimate was based upon a small portion of the known stock range. ~~Total U.S. fishery-related mortality and serious injury for this stock is less than 10% of the calculated PBR, and therefore can be considered to be insignificant and approaching a zero mortality and serious injury rate. This is a strategic stock because the species is listed as endangered under the ESA.~~ A ~~Draft~~ Recovery Plan for sperm whales ~~has been prepared and is available for review~~was finalized in 2010 (NMFS ~~2006~~2010).

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

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

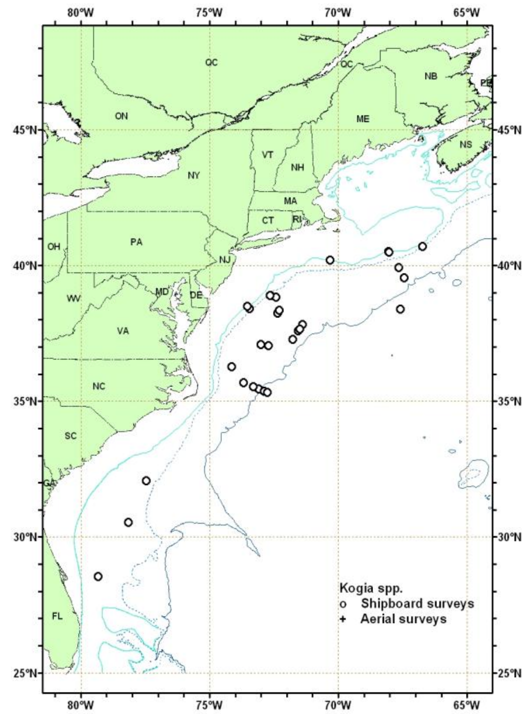

Figure 1. *Distribution of Kogia sp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 2004. Isobaths are at 100 m, 1,000 m and 4,000 m.*

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

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

POPULATION SIZE

~~Total~~ Abundance~~numbers of dwarf sperm whales off the U.S. or Canadian Atlantic coast are unknown, although e~~Eestimates from selected regions of the dwarf sperm whale habitat ~~do~~ exist for select time periods. Because *K.~~ogia~~ sima* and *K.~~ogia~~ breviceps* are difficult to differentiate at sea, the reported abundance estimates prior to the 2011 estimate are for both species of *Kogia*. The best abundance estimate for dwarf sperm whales is the result of the 2011 survey—1,042 (CV=0.65).~~The best abundance estimate for *Kogia* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 395 animals (CV=0.40), where the estimate from the northern U.S. Atlantic is 358 (CV=0.44), and from the southern U.S. Atlantic is 37 (CV=0.75). This joint estimate is considered~~

~~the best because these two surveys together have the most complete coverage of the species' habitat.~~

Earlier abundance estimates

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

Recent surveys and abundance estimates

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

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

An abundance estimate of 1,042 (CV=0.65) dwarf sperm whales was generated from a shipboard and aerial survey conducted during June - August 2011. The aerial portion~~ed~~ covered 6850 km of tracklines that were over waters ~~from Massachusetts to New Brunswick, Canada (waters~~ north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the ~~US and Canadian Gulf of Maine~~US and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy~~)~~. The shipboard portion~~ed~~ covered 3811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the US EEZ). The abundance estimates of dwarf sperm whales include a percentage of the estimate of animals identified as *Kogia* sp. (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified dwarf sperm whales to the total of positively identified pygmy sperm whales and positively identified dwarf sperm whales; the CV of the abundance estimate includes the variance of the estimated fraction. Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.

1. Summary of abundance estimates for the western North Atlantic *Kogia* sp.[a] Month, year, and overed during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation

Month/Year		N_{best}	CV

Jun-Aug 2004	Maryland to Bay of Fundy	358	0.44
Jun-Aug 2004	Florida to Maryland	37	0.75
Jun-Aug 2004	Bay of Fundy to Florida (COMBINED)	395	0.40
Jun-Aug 2011	North Carolina to lower Bay of Fundy	1,042	0.65~~8~~
[a]~~1~~ 2011 estimates are for dwarf sperm whales alone, not the *Kogia* sp.			

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 dwarf sperm whales ~~*Kogia* sp.~~ is 1,042 (CV=0.65) ~~395 (CV=0.40).~~ The minimum population estimate for dwarf sperm whales~~*Kogia* sp.~~ is ~~285~~ 632 animals.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997).~~—~~ The minimum population size for dwarf sperm whales~~*Kogia* sp.~~ is ~~285~~632.~~–~~ The maximum productivity rate is 0.04, the default value for cetaceans.~~—~~ The ~~"recovery"~~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 dwarf sperm whales~~*Kogia* sp.~~ is ~~2~~6.3.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III.~~–~~ Total annual estimated average fishery-related mortality and serious injury to these stocks during ~~2001~~2006-~~2005~~ 2010 was zero for ~~*Kogia* sp.~~ dwarf sperm whales, as there were no reports of mortality or serious injury to ~~these~~ this species.

Earlier Interactions

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

~~**Pelagic Longline**~~

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

Other Mortality

~~No dwarf sperm whales were reported to strand in Nova Scotia from 1990-2005 (T. Wimmer, Nova Scotia Marine Animal Response Society, pers. comm.).~~ From ~~2001~~2006-~~2005~~2010, ~~30~~ 32 dwarf sperm whales were reported stranded along the U.S. Atlantic coast ~~and 2 were reported stranded in~~and Puerto Rico (Table 2).~~–~~ In addition, there were 5 records of unidentified *Kogia*.~~In addition to the above strandings of *Kogia sima*, there were 11 strandings reported as *Kogia* sp.~~

~~There were no documented strandings of dwarf sperm whales along the U.S. Atlantic coast during 2001-2005 which were classified as likely caused by fishery or human interactions.~~

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

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

Table 2. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2006-2010. Strandings which were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.

STATE	2006			2007			2008			2009			2010			TOTALS		
-	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp
Maine	0	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	4	0
Massachusetts	0	1	0	0	1	1	0	2	0	1	2	0	0	0	0	1	6	1
Rhode Island	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0
New York	0	0	0	0	1	0	0	0	0	0	2	0	0	2	0	0	5	0
New Jersey	0	0	0	0	1	0	0	1	0	0	0	0	0	3	0	0	5	0
Delaware	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0
Maryland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	0	1	0	0	6	0	2	0	0	0	0	0	0	0	2	2	7	2
North Carolina	8	7	0	7	5	0	1	4	1	1	6	0	3	5	0	20	27	1
South Carolina	0	1	0	1	3	0	0	5	0	1	6	0	1	6	0	3	21	0
Georgia	0	2	0	0	1	0	0	3	0	0	2	0	0	2	0	0	10	0
Florida	1	2	0	1	5	0	2	5	0	0	6	0	2	17	1	6	35	1
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
TOTALS	9	18	0	9	27	1	5	20	1	3	26	0	6	36	3	32	127	5

There was one documented stranding of a dwarf sperm whale along the U.S. Atlantic coast during 2006-2010 which was classified as a human interaction. This was a 2006 Florida mortality that was classified as a fishery interaction.

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

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

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

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

STATUS OF STOCK

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

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October 2007December April2011January 2012

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

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

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

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

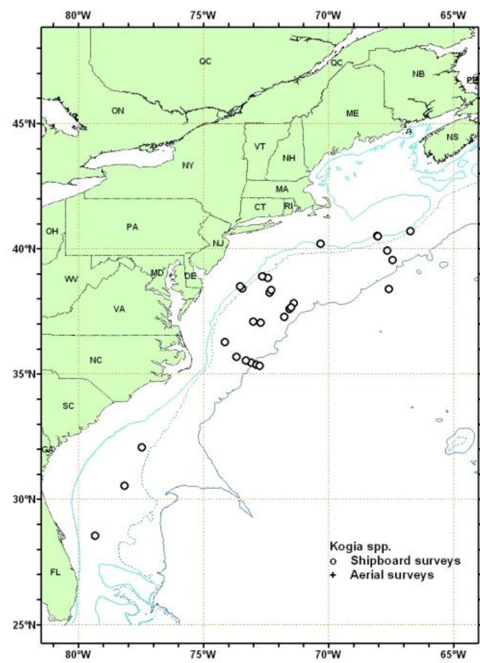

Figure 1. *Distribution of Kogia sp. sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 2004. Isobaths are at 100 m, 1,000 m and 4,000 m.*

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 prior to the 2011 estimate are for both species of *Kogia*. The best abundance estimate for pygmy sperm whales is the result of the 2011 survey—741 (CV=0.40).The best abundance estimate for *Kogia* sp. is the sum of the estimates from the two 2004 U.S. Atlantic surveys, 395 animals (CV=0.40), where the estimate from the northern U.S. Atlantic is 358 (CV=0.44), and from the southern U.S. Atlantic is 37 (CV=0.75). This joint estimate is considered the best because these two surveys together have the most complete coverage of the species' habitat.

Earlier abundance estimates

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

Recent surveys and abundance estimates

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

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

An abundance estimate of 741 (CV=0.40) pygmy sperm whales was generated from a shipboard and aerial survey conducted during June-August 2011. The aerial portioned covered 6,850 km of tracklines that were over waters from Massachusetts to New Brunswick, Canada (waters north of New Jersey and shallower than the 100-m depth contour,depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy)). The shipboard portioned covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the US EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimates of pygmy sperm whales include a percentage of the estimate of animals identified as *Kogia* sp. (the two species being sometimes hard to distinguish). The percentage used is the ratio of positively identified pygmy sperm whales to the total of positively identified pygmy sperm whales and positively identified dwarf sperm whales; the CV of the abundance estimate includes the variance of the estimated fraction. In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.

Table 1. Summary of abundance estimates for the western North Atlantic *Kogia* sp. [a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to Bay of Fundy	358	0.44
Jun-Aug 2004	Florida to Maryland	37	0.75
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	395	0.40

Jun-Aug 2011	North Carolina to lower Bay of Fundy	741	0.40
a. 2011 estimates are for pygmy sperm whales alone, not the *Kogia* sp.			

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 pygmy sperm whales~~*Kogia* sp.~~ is 741~~395~~ animals (CV=0.40).~~-~~ The minimum population estimate for pygmy sperm whales ~~*Kogia* sp.~~ is 535~~285~~ animals.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for pygmy sperm whales~~*Kogia* sp~~. is 535~~285~~.~~—~~ The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 pygmy sperm whales ~~*Kogia* sp.~~ is ~~2~~5.4.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

Detailed fishery information is reported in Appendix III. Total annual estimated average fishery-related mortality and serious injury to these stocks during ~~2001~~2006-~~2005~~ 2010 was zero for pygmy sperm whales~~*Kogia* sp.~~, as there were no reports of mortality or serious injury to ~~these~~ this species.

Earlier Interactions

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

~~**Pelagic Longline**~~

Between 1992 and 2005, 1 *Kogia* sp.~~–~~ was hooked, released alive and considered seriously injured in the pelagic longline fishery in the Atlantic in 2000 (Yeung 2001).

Other Mortality

~~No pygmy sperm whales were reported to strand in Nova Scotia from 1990-2005 (T. Wimmer, Nova Scotia Marine Animal Response Society, pers. comm.).~~ From ~~2001~~2006-~~2005~~2010, ~~51~~ 127 pygmy sperm whales were reported stranded along the U.S. Atlantic coast and Puerto Rico (Table 2). In addition, there were 5 records of unidentified *Kogia*.

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

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

Table 2. Dwarf and pygmy sperm whale (*Kogia sima* (Ks), *Kogia breviceps* (Kb) and *Kogia* sp. (Sp)) strandings along the Atlantic coast, 2006-2010. Strandings which were not reported to species have been reported as *Kogia* sp. The level of technical expertise among stranding network personnel varies, and given the potential difficulty in correctly identifying stranded *Kogia* whales to species, reports to specific species should be viewed with caution.

STATE	2006			2007			2008			2009			2010			TOTALS		
-	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp	Ks	Kb	Sp
Maine	0	1	0	0	2	0	0	0	0	0	1	0	0	0	0	0	4	0
Massachusetts	0	1	0	0	1	1	0	2	0	1	2	0	0	0	0	1	6	1
Rhode Island	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	0
New York	0	0	0	0	1	0	0	0	0	0	2	0	0	2	0	0	5	0
New Jersey	0	0	0	0	1	0	0	1	0	0	0	0	0	3	0	0	5	0
Delaware	0	2	0	0	2	0	0	0	0	0	0	0	0	0	0	0	4	0
Maryland	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	0	1	0	0	6	0	2	0	0	0	0	0	0	0	2	2	7	2
North Carolina	8	7	0	7	5	0	1	4	1	1	6	0	3	5	0	20	27	1
South Carolina	0	1	0	1	3	0	0	5	0	1	6	0	1	6	0	3	21	0
Georgia	0	2	0	0	1	0	0	3	0	0	2	0	0	2	0	0	10	0
Florida	1	2	0	1	5	0	2	5	0	0	6	0	2	17	1	6	35	1
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0
TOTALS	9	18	0	9	27	1	5	20	1	3	26	0	6	36	3	32	127	5

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

There were 16 documented strandings of pygmy sperm whales along the U.S. Atlantic coast during 2006-2010 which were classified as human interactions. In 2006, mortalites in Maine, North Carolina and Rhode Island (1 each) were classified as human interactions. In Massachusetts in 2007, a pygmy sperm whale was classified as a human interaction because it was pushed off the beach. The animal was last seen swimming with its mother. Two other human interaction cases were documented in 2007—one in South Carolina and one (fishery interaction) in Virginia. In 2008, one animal in Georgia was classified as a human interaction. In 2009, there was a fishery interaction stranding mortality in Massachusetts and a human interaction in South Carolina~~,~~. There were 7 strandings classified as human interactions in 2010—3 in Florida, 2 in New Jersey and 2 in South Carolina (one of them classified as a fishery interaction).

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

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

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

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

STATUS OF STOCK

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

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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; MacLeod *et al.* 2006; Jefferson *et al.* 2008). Stock structure in the North Atlantic is unknown.

Cuvier's beaked whale sightings have occurred principally along the continental shelf edge in the Mid-Atlanticmid-Atlantic region off the northeast U.S. coast (CETAP 1982; Waring *et al.* 1992; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring or summer.

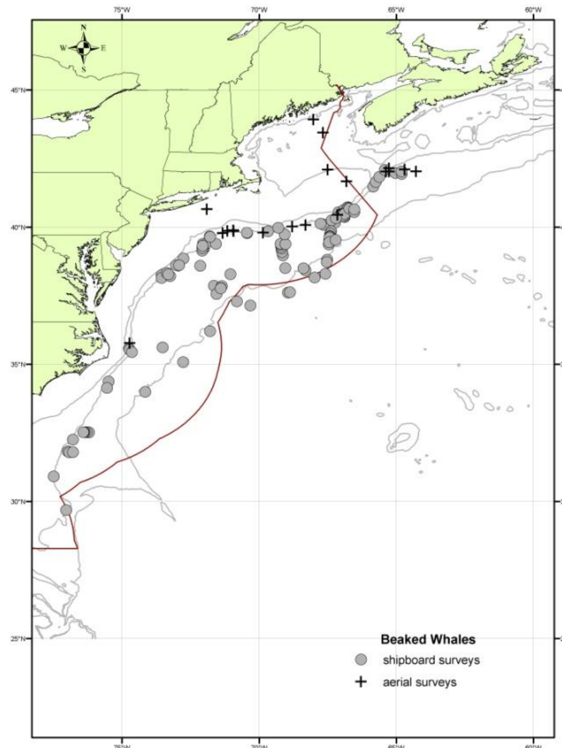

Figure 1. *Distribution of beaked whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006 and, 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

POPULATION SIZE

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

However, several Eestimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006) as well as one estimate of Cuvier's beaked whales alone. Observers have gained experience at distinguishing between species of beaked whales, enabling a single species estimate. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Cuvier's beaked whales is result of the 2011 survey—5,611 (CV=0.42)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=0.578), 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.

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, and should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

An abundance estimate of 822 (CV=0.81) undifferentiated beaked whales was obtained from an aerial survey conducted in July and August 2002 which covered 7,465 km of trackline over waters from the 1000 m depth contour on the southern edge of Georges Bank to Maine (Table 1; Palka 2006). The value of g(0) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.

An abundance of 2,839 (CV=0.78) 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 (38ºN) to the Bay of Fundy (45ºN) (Table 1: Palka 2006). Shipboard data were collected using the two--independent--team line-transect method and analyzed using the modified direct direct-duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the Mid-Atlanticmid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias *g(0)* and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36).

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region -from the 2000 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An abundance estimate of 5,611 (CV=0.42) Cuvier's beaked whales was generated from a shipboard and aerial survey conducted during June-August 2011. The aerial portioned covered 6,850 km of tracklines that were over waters from Massachusetts to New Brunswick, Canada (waters north of New Jersey and shallower than the 100-m depth contour, depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy). The shipboard portioned covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida. The abundance estimates from this southern survey are being calculated and are not available at this time.

Although the 1990-20112006 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 1990-20112004 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys Recent results suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001; Hamazaki 2002).

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[a] of beaked whales which include *Ziphius* and *Mesoplodon* 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
~~Aug 2002~~	~~S. Gulf of Maine to Maine~~	~~822~~	~~0.81~~
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
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jul-Aug 2011[a]	North Carolina to lower Bay of Fundy	5,611	0.42
a. 2011estimates are for Cuvier's beaked whales alone, not the undifferentiated complex.			

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 Cuvier's ~~undifferentiated~~ beaked whales is ~~3,513~~5,611 (CV=0.~~63~~42). The minimum population estimate for ~~the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.)~~Cuvier's beaked whales is 3,992.~~2,154~~~~4,484.~~ ~~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 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"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for ~~the undifferentiated complex of~~Cuvier's beaked whales is 3,992.~~2,154~~~~4,484.~~ The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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.~~0.4 because the CV for the fishery mortality estimate exceeds 0.8.~~ PBR for ~~all species in the undifferentiated complex of~~Cuvier's beaked whales ~~(*Ziphius* and *Mesoplodon* spp.)~~ is 40.~~45~~~~17.~~ ~~It is not possible to determine the PBR for only Cuvier's beaked whales.~~

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 2006-2010 ~~2003-2007~~ minimum ~~total~~ annual rate of human-caused ~~average estimated annual~~ mortality of Cuvier's beaked whales averaged 0.4 animals per year. This is from two stranding records that showed signs of human interaction (1 fishery and 1 vessel strike) (Table 3).~~in fisheries in the U.S. Atlantic EEZ was 1.0, derived from average annual fishery bycatch of one animal (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.

Total annual estimated average fishery-related mortality or serious injury of this stock in 2006-2010 2003-2007 in the U.S. observed fisheries was zero. listed below was 1 beaked whale (CV=1.0). Detailed fishery information is reported in Appendix III.

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 prior to 2003 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 for Cuvier's beaked whales are 1 in 1994 (0.14) and zero for the years 1995-1996 and 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

Pelagic Longline

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions were reported prior to 2003 or in 2005-2010.2007. The annual average estimated average combined mortality and serious injury in 2006-2010 was zero Cuvier's beaked whales.2003-2007 was 1 beaked whale (CV=1.0; Table 2).

Table 2. Summary of the incidental mortality of Beaked Whales (*Ziphius cavirostris* and *Mesoplodon* sp.) 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 (excluding NED-E) [b,c]	03-07	63, 60, 60, 63, 62	Obs. Data Logbook	.09, .09, .06, .07, .08	1, 0, 0, 0, 0	0, 0, 0, 0, 0	5.3, 0, 0, 0, 0	0, 0, 0, 0, 0	5.3, 0, 0, 0, 0	1.0, 0, 0, 0, 0	1(1.0)
TOTAL											1 (1.0)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).

[b] 2003 SI estimates were taken from Table 10 in Garrison and Richards (2004).

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

Other Mortality

During 2006-2010 eight Cuvier's beaked whales stranded along the U.S. Atlantic coast (Table 3). Two animals showed evidencee of a human interaction. From 1992 to 2002, a total of 69 beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). This includes: 38 (includes one tentative identification) Gervais' beaked whales (one 1997 animal and one 2002 animal had plastics in stomach; 2 animals that stranded in September 1998 in South Carolina showed signs of fishery interactions; one Florida 2001 animal showed signs of blunt trauma; one 2002 animal may have been involved in a ship strike); 3 True's beaked whales; 6 Blainville's beaked whales; 1 Sowerby's beaked whale; 14 Cuvier's beaked whales (one 1996 animal had propeller marks, and one 2000 animal had a longline hook in the lower jaw) and 7 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, sSeveral unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities (Cox *et al.* 2006; D'Amico et al. 2009; Fernandez *et al.* 2005; Filadelfo et al. 2009). . During the mid- to late 1980's 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; D'Amico et al. 2009; Filadelfo et al. 2009). 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; NMFS 2001; Cox *et al.* 2006). 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.* 2006). Ocean Conservation Research has assembled a partial list of cetacean strandings, mostly beaked whales, that may have been associated with military generated noise. (http://ocr.org/research/impacts/military-associated-strandings.pdf, accessed 21 Oct 2009).

Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005).

During 2003-2007, nine Cuvier's beaked whales stranded along the U.S. Atlantic coast (Table 2). Two of these animals were classified as having signs of human interaction, however, as the cause of death of stranded animals is not being evaluated (interactions may be non-fatal or even post-mortem), these animals are not included in annual human-induced mortality estimates.

Table 3. Cuvier's beaked whale (*Ziphius cavirostris*) strandings along the U.S. Atlantic coast.

State	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Massachusetts	1	0	0	0	0	**1**
New Jersey[a]	0	0	1	0	0	**1**
Georgia	1	0	1	0	0	**2**
South Carolina[b]	0	1	0	0	0	**1**
Florida	0	2	1	0	0	**3**
Total	**2**	**3**	**3**	**0**	**0**	**8**

a. -Animal in New Jersery in 2008 had fishing net and a wood fragment found in the GI tract.
b. Animal in South Carolina in 2007 displayed signs of having been involved in a boat collision.

Table 3. Cuvier's beaked whale (*Ziphius cavirostris*) strandings along the U.S. Atlantic coast.

State	2003	2004	2005	2006	2007	Total
Massachusetts				1		1
New Jersey			1			1
Georgia[a]			1	1		2
South Carolina[b]	2				1	3
Florida	1				2	3
Total	3	0	2	2	3	10

a. Animal in Georgia in 2005 had plastic debris found in the stomach.
b. Animal in South Carolina in 2007 displayed signs of having been involved in a boat collision.

STATUS OF STOCK

ThisThe western North Atlantic stock of Cuvier's beaked whale is not a strategic stock because average annual human-related mortality and serious injury does not exceed PBR. The total U.S. fishery mortality and serious injury for this group of species is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. 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 U.S. fishery mortality and serious injury for this group of species 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 because average annual human-related mortality and serious injury does not exceed PBR.

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BLAINVILLE'S BEAKED WHALE (*Mesoplodon densirostris*): 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, *M. 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. Therefore, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (L~~l~~onghurst 1998; Spalding et al. 2007).

The distribution of *Mesoplodon* spp. in the northwest Atlantic is known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006; Jefferson et al. 2008). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

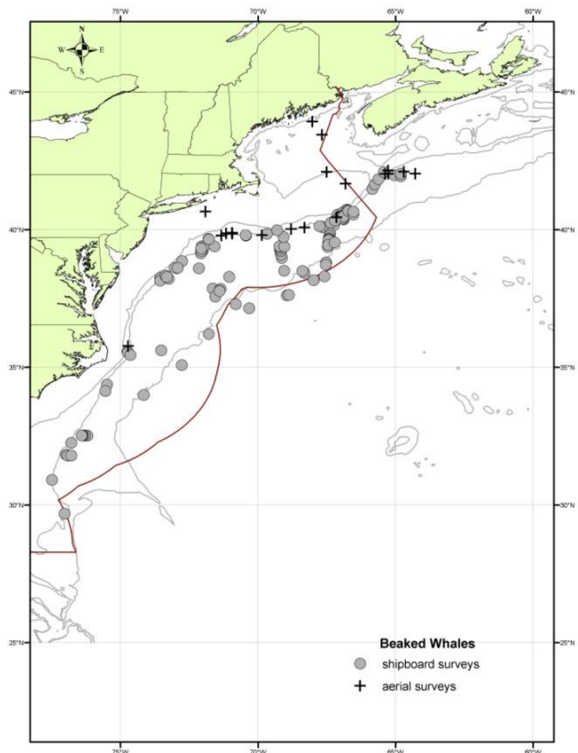

Figure 2~~1~~: *NEFSC and SEFSC shipboard and aerial surveys during the summers of **1995,** 1998, 1999, 2002, 2004, 2006**,** ~~and~~ 2007**, 2008, and 2010**. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Blainville's beaked whales have been reported from southwestern Nova Scotia to Florida, and are believed to be widely but sparsely distributed (Leatherwood *et al.* 1976; Mead 1989; Nicolas *et al.* 1993; MacLeod *et al.* 2006; Jefferson et al. 2008). 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).

POPULATION SIZE

The total number of Blainville's beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown, and seasonal abundance estimates are not available for this stock. However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006). Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). ~~The best 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 =0.578), 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.~~

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than~~

~~eight years are deemed unreliable and should not be used for PBR determinations.~~

Recent surveys and abundance estimates

~~An abundance estimate of 822 (CV=0.81) undifferentiated beaked whales was obtained from an aerial survey conducted in July and August 2002 which covered 7,465 km of trackline over waters from the 1000 m depth contour on the southern edge of Georges Bank to Maine (Table 1; Palka 2006). The value of g(0) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.~~

An abundance of 2,839 (CV=0.78) 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 (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and g(0), the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for g(0) and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf S~~s~~tream front in the ~~Mid-Atlantic~~mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36*)*.

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.)

No beaked whales sighted~~ings~~ during a shipboard and aerial abundance survey conducted during June-August 2011 were identified as Blainville's beaked whales ~~during a shipboard and aerial abundance survey conducted during June-August 2011~~. —The aerial portione~~d~~ covered 6,850 km of tracklines that were over waters ~~from Massachusetts to New Brunswick, Canada (waters~~ north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the ~~US and Canadian Gulf of Maine~~US and Canadian Gulf of Maine, and up to and including the lower Bay of Fundy~~)~~. The shipboard portione~~d~~ covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the US EEZ). In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida)~~,~~. The abundance estimates from this southern survey are being calculated and are not available at this time.

Although the 1990-2011~~2006~~ 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 1990-2011~~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. NMFS survey results ~~Recent results~~ suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001, Hamazaki 2002).

Because the estimates presented here were not dive-time corrected, they are likely negatively biased and probably underestimate actual abundance. Given that *Mesoplodon* spp. prefer~~s~~ 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 *Ziphius* and *Mesoplodon* 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
~~Aug 2002~~	~~Georges Bank to Maine coast~~	~~822~~	~~0.81~~
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
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47

Minimum Population Estimate

Present data are insufficient- to calculate a minimum population estimate for this stock. ~~The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 3,513 (CV =0.63) and the minimum population estimate is 2,154. It is not possible to determine the minimum population estimate of only Blainville's beaked whales.~~

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon* spp. 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 5.5 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 (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"~~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"~~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.~~0.4 because the CV for the fishery mortality estimate exceeds 0.8.~~ PBR for the western North Atlantic stock of Blainville's beaked whales is unknown because the minimum population size is unknown. ~~all species in the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 17. It is not possible to determine the PBR for only Blainville's beaked whales.~~

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 2006-2010~~2003-2007~~ total average estimated annual mortality of Blainville's beaked whales in fisheries in the U.S. Atlantic EEZ is 0.2 ~~1.2 and is derived from two components: 1) estimated average annual fishery bycatch of one animal from observed fisheries (Table 2), and 2)~~based on one stranded animal likely killed in 2007 by fishery entanglement (Table 3).

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.

Estimated annual average fishery-related mortality or serious injury of this stock in 2006-2010 in U.S. fisheries was zero. ~~2003-2007 in the U.S. fisheries listed below was 1 beaked whale (CV=1.0)(Table 1). 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 prior to 2003 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) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period 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). Estimates of bycatch mortality by species are available for the 1994-1998 period. None of the animals were identified as Blainville's beaked whales. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

~~**Pelagic Longline**~~

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions were reported prior to 2003 or in 2004 ~~-~~– 2010.~~2007.~~ The estimated average combined mortality in 2006-2010~~2003-2007~~ was zero~~1~~ beaked whales. ~~(CV=1.0)(Table 2).~~

~~Table 2. Summary of the incidental mortality of Beaked Whales (*Ziphius cavirostris* and *Mesoplodon* sp.) 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 (excluding NED-E)[b,c]~~	~~03-07~~	~~63, 60, 60, 63,62~~	~~Obs. Data Logbook~~	~~.09, .09, .06, .07, .08~~	~~1, 0, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~05.3, 0, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~5.3, 0, 0, 0, 0~~	~~1.0, 0, 0, 0, 0~~	~~1(1.0)~~
~~TOTAL~~											~~1 (1.0)~~

~~a Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).~~

~~b 2003 SI estimates were taken from Table 10 in Garrison and Richards (2004).~~

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

Other Mortality

From ~~1992~~2006-2010~~2002~~, a total of ~~12369~~ 4 Blainville's beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). ~~This includes: 6138 (includes one tentative identification) Gervais' beaked whales (one 1997 animal and one 2002 animal had plastics in stomach; 2 animals that stranded in September 1998 in South Carolina showed signs of fishery interactions; one Florida 2001 animal showed signs of blunt trauma; one 2002 animal may have been involved in a ship strike); 73 True's beaked whales~~ (one in 2003 that stranded in

Virginia was entangled in fishing gear); 146 Blainville's beaked whales (oOne animal in 2007 that stranded in South Carolina was classified as a fishery interaction) ; 51 Sowerby's beaked whales (one in 2003 that stranded in Maine was likely killed by a boat strike); 2714 Cuvier's beaked whales (one 1996 animal had propeller marks;, and one 2000 animal had a longline hook in the lower jaw; one in 2005 that stranded in Georgia had plastic debris in the stomach; one in 2007 in South Carlonia that displayed signs of a boat strike; and one in 2008 that stranded in New Jersey had net and wood fragments in the GI tract); and 79 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, sSeveral unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities (D'Amico et al. 2009; Filadelfo et al. 2009). During the mid- to late 1980's 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; D'Amico et al. 2009; Filadelfo et al. 2009). 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; NMFS 2001; Cox *et al.* 2006). 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.* 2006). Ocean Conservation Research has assembled a partial list of cetacean strandings, mostly beaked whales, that may have been associated with military-generated noise. (http://ocr.org/research/impacts/military-associated-strandings.pdf, accessed 21 Oct 2009).

During 2006-20102003-2007,four seven Blainville's beaked whales and two unidentified *Mesoplodon* whales stranded along the U.S. Atlantic coast and Puerto Rico (Table 32). One of the Blainville's beaked whales showed se animals was classified as having physical evidence of human interaction. Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005).

Table 2. Blainville's beaked whale (*Mesoplodon densirostris*) strandings along the U.S. Atlantic coast.

State	2006	2007	2008	2009	2010	Total
North Carolina	1	1	1	0	0	3
South Carolina[a]	0	1	0	0	0	1
Total	**1**	**2**	**1**	**0**	**0**	**4**

a. Animal in South Carolina in 2007 is classified as a fishery interaction due to entanglement marks around its peduncle.

Table 3. Blainville's beaked whale (*Mesoplodon densirostris*) strandings along the U.S. Atlantic coast and Puerto Rico.

State	2003	2004	2005	2006	2007	Total

-	-	-	-	-	~~*M. densirostris*~~	~~*Mesoplodon* spp.~~	-
~~Rhode Island~~	-	-	-	-	-	~~1~~	~~1~~
~~North Carolina~~	-	~~1~~	~~1~~	~~1~~	~~1~~	~~1~~	~~5~~
~~South Carolina[a]~~	-	-	~~1~~	-	~~1~~	-	~~2~~
~~Puerto Rico~~	-	~~1~~	-	-	-	-	~~1~~
~~**Total**~~	~~**0**~~	~~**2**~~	~~**2**~~	~~**1**~~	~~**2**~~	~~**2**~~	~~**9**~~
~~a. Animal in South Carolina in 2007 is classified as a fishery interaction due to entanglement marks around its peduncle.~~							

STATUS OF STOCK

The western North Atlantic stock of Blainville's beaked whale is not a strategic stock. There are insufficient data to determine the population size or trends, and PBR cannot be calculated for this stock. The permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and a single 2007 stranding record was the only fishery-related mortality and serious injury observed during the recent 5-year (2006-2010) period. Therefore, total U.S. fishery-related mortality and serious injury rate can be considered to be insignificant and approaching zero. The status of Blainville's beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. This 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. Although a species-specific PBR cannot be determined, tThe permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality, and a single 2007 stranding record is the only fishery-related mortality and serious injury has been observed during the recent 5-year (2006-2010) period. The total U.S. fishery mortality and serious injury for this group of species is less than 10% of the calculated PBR and, Ttherefore, total U.S. fishery-related mortality and serious injury rate can be considered to be insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock. because average annual human-related mortality and serious injury does not exceed PBR.~~

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GERVAIS' BEAKED WHALE (*Mesoplodon europaeus*): 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. Therefore, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (~~longhurst~~ Longhurst 1998; Spalding et al. 2007).

The distribution of *Mesoplodon* spp. in the northwest Atlantic is known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006; Jefferson et al. 2008). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

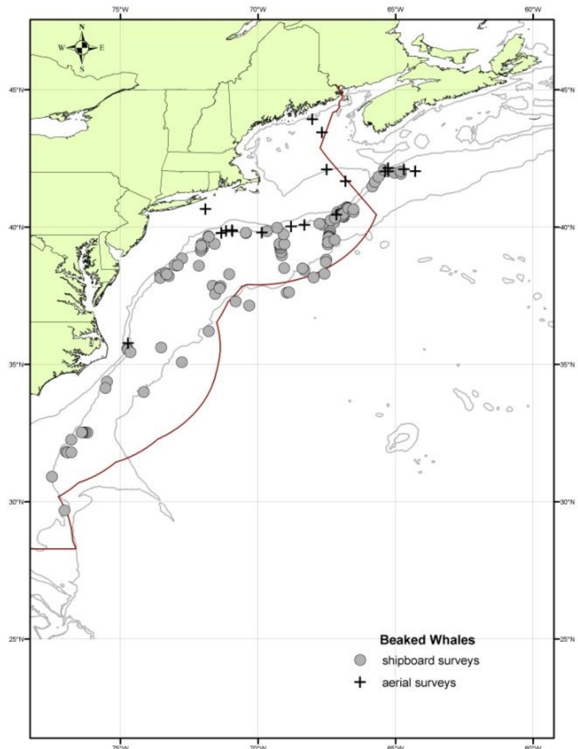

Figure 1: *NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, and 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

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 (NMFS unpublished data; Leatherwood *et al.* 1976; Mead 1989; MacLeod *et al.* 2006; Jefferson et al. 2008). This is the most common species of *Mesoplodon* to strand along the U.S. Atlantic coast. The northernmost stranding was on Cape Cod (Moore *et al.* 2005) .

POPULATION SIZE

The total number of Gervais' 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 are available for select time periods (Barlow *et al.* 2006), as well as one estimate of Gervais' beaked whales alone. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Gervais' beaked whales is the result of the 2011 survey – 1,945 (CV=1.0).

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. Due to changes in survey methodology these data should not be used to make comparisons to more current estimates.

Recent surveys and abundance estimates

An abundance of 2,839 (CV=0.78) 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 (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf stream front in the ~~Mid-Atlantic~~mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36).

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An abundance estimate of 1,945 (CV=1.00) Gervais' beaked whales was generated from a shipboard and aerial survey conducted during June - August 2011. The aerial portion~~ed~~ covered 6,850 km of tracklines that were over waters ~~from Massachusetts to New Brunswick, Canada (waters~~ north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy~~)~~. The shipboard portion~~ed~~ covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). The abundance estimate includes a percentage of the estimate of animals identified as *Mesoplodon* spp. The percentage used is the ratio of positively identified Gervais' beaked whales to the total of positively identified Sowerby's beaked whales and positively identified Gervais' beaked whales; the CV of the abundance estimate includes the variance of the estimated fraction. In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida, The abundance estimates from this southern survey are being calculated and are not available at this time.

Although the 1990-2011 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 1990-2011 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001; Hamazaki 2002).

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 *Ziphius* and *Mesoplodon* spp.[a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to the Bay of Fundy	2,839	0.78

Jun-Aug 2004	Florida to Maryland	674	0.36
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	3,513	0.63
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Jun-Aug 2011[a]	North Carolina to lower Bay of Fundy	1,945	1.00

[a] 2011estimates are for Gervais' beaked whales alone, not the undifferentiated complex.

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 Gervais' beaked whales is 1,945 (CV=1.00). The minimum population estimate for Gervais' beaked whales is 966.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon spp.* life history parameters that could be used to estimate net productivity include: length at birth is 2 to 3 m, length at sexual maturity 6.1 m 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 (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"~~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"~~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. PBR for Gervais' beaked whales is ~~10~~9.7.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 2006-2010 total average estimated annual mortality of Gervais' beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.

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.

Estimated annual average fishery-related mortality or serious injury of this stock in 2006-2010 in U.S. fisheries was zero. 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 prior to 2003 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) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period 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). Estimates of bycatch mortality by species are available for the 1994-1998 period, although none of the animals were identified as Gervais' beaked whales. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions were reported prior to 2003 or in 2004 – 2010. The annual average combined mortality and serious injury in 2006-2010 was zero beaked whales.

Other Mortality

During 2006-2010, 17 Gervais' beaked whales stranded along the U.S. Atlantic coast (Table 2). None of these animals displayed signs of human interaction.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with naval activities(D'Amico et al. 2009; Filadelfo et al. 2009. During the mid- to late 1980's 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; A'Amico et al. 2009; Filadelfo et al. 2009). 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; NMFS 2001; Cox *et al.* 2006). 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.* 2006). Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005).
~~Ocean Conservation Research has assembled a partial list of cetacean strandings, mostly beaked whales, that may have been associated with military-generated noise. (http://ocr.org/research/impacts/military-associated-strandings.pdf, accessed 21 Oct 2009).~~

Table 3. Gervais' beaked whale (*Mesoplodon europaeus*) strandings along the U.S. Atlantic coast.						
State	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
New Jersey	0	0	1	0	1	**2**
Maryland	0	0	0	1	1	**2**
Virginia	0	1	0	1	1	**3**
North Carolina	0	1	0	1	1	**3**
Georgia	0	0	0	0	1	**1**
Florida	0	1	2	2	1	**6**
Total	**0**	**3**	**3**	**5**	**6**	**17**

STATUS OF STOCK

Th~~is~~e western North Atlantic stock of Gervais' beaked whale is not a strategic stock because average annual human-related mortality and serious injury does not exceed PBR. The total U.S. fishery mortality and serious injury for this group of species is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of Gervais' beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. This species is not listed as threatened or endangered under the Endangered Species Act. ~~The total U.S. fishery mortality and serious injury for this group of species 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 because average annual human-related mortality and serious injury does not exceed PBR.

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SOWERBY'S BEAKED WHALE (*Mesoplodon bidens*): 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, *M. 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. Therefore, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (lLonghurst 1998; Spalding et al. 2007).

The distribution of *Mesoplodon* spp. in the northwest Atlantic is known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006). Off the U.S. Atlantic coast, beaked whale (*Ziphius* and *Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). Most sightings were in late spring and summer, which corresponds to survey effort.

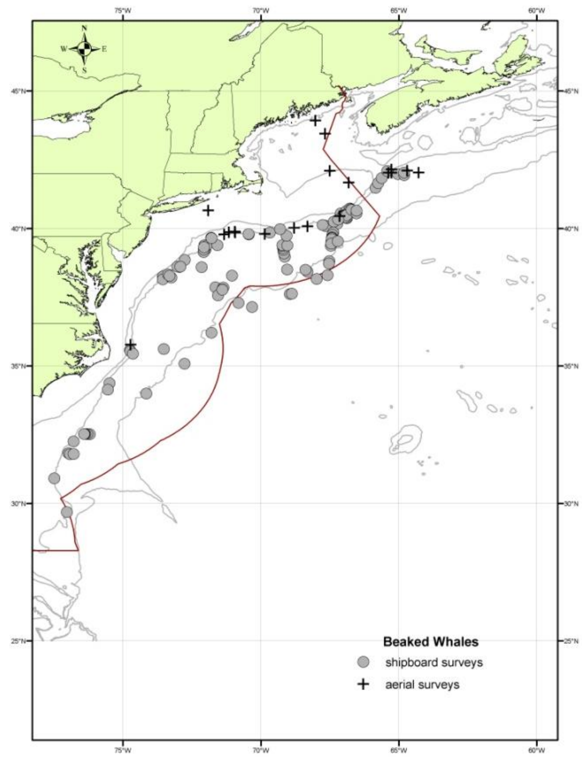

Figure 1: N***Distribution of beaked whale sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, and 2007, 2008 and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.***

Sowerby's beaked whales have been reported from New England waters north to the ice pack (e.g., Davis Strait), and individuals are seen along the Newfoundland –coast in summer (Leatherwood *et al.* 1976; Mead 1989;- MacLeod *et al.* 2006; Jefferson et al. 2008). Furthermore, a single stranding occurred off the Florida west coast (Mead 1989). This species is considered rare in Canadian waters (Lien *et al.* 1990) *et al.* 1990) and has been designated as "Special Concern" by the Committee On on the Status of -Endangered Wildlife in Canada (COSEWIC).

POPULATION SIZE

The total number of Sowerby's beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown. However, sSeveral estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006)), as well as one estimate of Sowerby's beaked whales alone.. Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Sowerby's beaked whales is the result of the 2011 survey – 3,748 (CV=0.86).). The abundance estimate includes a percentage of the estimate of animals identified as *Mesoplodon* spp. The percentage used is the ratio of positively identified Sowerbys beaked whales to the total number of positively identified *Mesoplodon* spp. 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=0.578), 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.

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. Due to changes in survey methodology these data should not be used to make comparisons to more current estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.

Recent surveys and abundance estimates

An abundance estimate of 822 (CV=0.81) undifferentiated beaked whales was obtained from an aerial survey conducted in July and August 2002 which covered 7,465 km of trackline over waters from the 1000 m depth contour on the southern edge of Georges Bank to Maine (Table 1; Palka 2006). The value of g(0) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.

An abundance of 2,839 (CV=0.78) 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 (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and g(0), the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for g(0) and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf stream front in the Mid-Atlanticmid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36*)*.

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.)

An abundance estimate of 3,748 (CV=0.86) Sowerby's beaked whales was generated from a shipboard and aerial survey conducted during June--August 2011. The aerial portioned covered 6,850 km of tracklines that were over waters from Massachusetts to New Brunswick, Canada (waters north of New Jersey and shallower than the 100-m depth contour,depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy). The shipboard portioned covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). The abundance estimate includes a percentage of the estimate of animals identified as *Mesoplodon* spp. The percentage used is the ratio of positively identified Sowerby's beaked whales to the total of positively identified Sowerby's beaked whales and positively identified Gervais' beaked whales; the CV of the abundance estimate includes the variance of the estimated fraction.. Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida)., The abundance estimates from this southern survey are being calculated and are not available at this time.

Although the 1990-20112006 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 1990-20112004 data suggest that, seasonally, at least several thousand beaked whales are occupying these waters, with highest levels of abundance in the Georges Bank region. NMFS surveys Recent results suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001; Hamazaki 2002).

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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 *Ziphius* and *Mesoplodon* spp.[a] Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Aug 2002	Georges Bank to Maine coast	822	0.81
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
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47
Junl-Aug 2011[a]	North Carolina to lower Bay of Fundy	3,748	0.86

[a] 2011estimates are for Sowerby's beaked whales alone, not the undifferentiated complex

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 Sowerby's the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 3,748 (CV=0.86),3,513 (CV =0.63) and the minimum population estimate is 2,0082,154. It is not possible to determine the minimum population estimate of only Sowerby's beaked whales.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon* spp. 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"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"~~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. ~~0.4 because the CV for the fishery mortality estimate exceeds 0.8.~~ PBR for Sowerby's ~~all species in the undifferentiated complex of~~ beaked whales ~~(*Ziphius* and *Mesoplodon* spp.)~~ is 20. ~~17. It is not possible to determine the PBR for only Sowerby's beaked whales.~~

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 2006-2010 ~~2003-2007~~ total average estimated annual mortality of ~~Sowerby's~~ beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.~~1.2 and is derived from two components: 1) estimated average annual fishery bycatch of one animal from observed fisheries (Table 2), and 2) one stranded animal likely killed by boat strike (Table 3).~~

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.

Estimated annual average fishery-related mortality or serious injury of this stock in 2006-2010 ~~2003-2007~~ in ~~the~~ U.S. fisheries was zero. ~~listed below was 1 beaked whale (CV=1.0;Table 1).~~ 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 prior to 2003 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) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period 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). Estimates of bycatch mortality by species are available for the 1994-1998 period. For animals identified as Sowerby's beaked whales, bycatch estimates were 3 (0.09) in 1994, 6 (0) in 1995, 9 (0.12) in 1996 and 2 (0) in 1998. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0.25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

~~**Pelagic Longline**~~

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions were reported prior to 2003 or in 2004 ~~-~~– 2010.~~2007.~~ The estimated average combined mortality in 2006-2010 ~~2003-2007~~ was zero~~1~~ beaked whales. ~~(CV=1.0)(Table 2).~~

~~Table 2. Summary of the incidental mortality of Beaked Whales (*Ziphius cavirostris* and *Mesoplodon* sp.) 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 (excluding NED-E) [b,c]	03-07	63, 60, 60, 63,62	Obs. Data Logbook	.09, .09, .06, .07, .08	1, 0, 0, 0, 0	0, 0, 0, 0, 0	05.3, 0, 0, 0, 0	0, 0, 0, 0, 0	5.3, 0, 0, 0, 0	1.0, 0, 0, 0, 0	1(1.0)
TOTAL											1 (1.0)

a Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).

b 2003 SI estimates were taken from Table 10 in Garrison and Richards (2004).

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

Other Mortality

During 2006-2010 three Sowerby's beaked whales stranded along the U.S. Atlantic coast (Table 3). None of these animals showed evidence of a human interaction.*From* 1992-20022010, a total of 69 123 beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). This includes: 61 38 (includes one tentative identification) Gervais' beaked whales (one 1997 animal and one 2002 animal had plastics in their stomach; 2 animals that stranded in September 1998 in South Carolina showed signs of fishery interactions; one Florida 2001 animal showed signs of blunt trauma; one 2002 animal may have been involved in a ship strike); 7 3 True's beaked whales (one in 2003 that stranded in Virginia was entangled in fishing gear); 14 6 Blainville's beaked whales (one in 2007 that stranded in South Carolina was classified as a fishery interaction); 51 Sowerby's beaked whales (one in 2003 that stranded in Maine was likely killed by a boat strike); 2714 Cuvier's beaked whales (one 1996 animal had propeller marks,; and one 2000 animal had a longline hook in the lower jaw; one in 2005 that stranded in Georgia had plastic debris in the stomach; one in 2007 in South Carolina that displayed signs of a boat strike; and one in 2008 that stranded in New Jersey had net and wood fragments in the GI tract), and 97 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, sSeveral unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities (D'Amico et al. 2009; Filadelfo et al. 2009). During the mid- to late 1980's 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; DA'Amico et al. 2009; Filadelfo et al. 2009). 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; NMFS 2001; Cox *et al.* 2006). 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.* 2006). Ocean Conservation Research has assembled a partial list of cetacean strandings, mostly beaked whales, that may have been associated with military-generated noise. (http://ocr.org/research/impacts/military-associated-strandings.pdf, accessed 21 Oct 2009). Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005).

During 2006-20102003-2007,three two Sowerby's beaked whales and two unidentified *Mesoplodon* whales stranded along the U.S. Atlantic coast (Table 3). None of One of these animals showed was classified as showing evidence of a human interaction.

Table 3. Sowerby's beaked whale (*Mesoplodon bidens*) strandings along the U.S. Atlantic coast.						
State	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Rhode Island	0	1	0	0	0	**1**
Virginia	0	0	0	2	0	**2**
Total	0	1	0	2	0	**3**

Table 3. Sowerby's beaked whale (*Mesoplodon bidens*) strandings along the U.S. Atlantic coast.							
State	**2003**	**2004**	**2005**	**2006**	**2007**		**Total**
-	-	-	-	-	***M. bidens***	***Mesoplodon spp.***	-
Maine[a]	1	-	-	-	-	-	**1**
Rhode Island	-	-	-	-	-	1	**1**
Georgia	-	1	-	-	-	-	**1**
North Carolina		-	-	-	-	1	**1**
Total	1	1	0	0	0	2	**4**

[a] Maine 2003 animal was likely killed by boat strike.

STATUS OF STOCK

Thise western North Atlantic stock of Sowerby's beaked whale is not a strategic stock because average annual human-related mortality and serious injury does not exceed PBR. The total U.S. fishery mortality and serious injury for this group of species is less than 10% of the calculated PBR and, therefore, can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of Sowerby's beaked whales relative to OSP in 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 U.S. fishery mortality and serious injury for this group of species 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 because average annual human-related mortality and serious injury does not exceed PBR.

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TRUE'S BEAKED WHALE (*Mesoplodon mirus*): 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, *M. 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. Therefore, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (~~l~~Longhurst 1998; Spalding et al. 2007).

The distribution of *Mesoplodon* spp. in the northwest Atlantic is known principally from stranding records (Mead 1989; Nawojchik 1994; Mignucci-Giannoni *et al.* 1999; MacLeod *et al.* 2006; Jefferson et al. 2008). Off the U.S. Atlantic coast, beaked whale (*Mesoplodon* spp.) sightings have occurred principally along the shelf-edge and deeper oceanic waters (Figure 1; CETAP 1982; Waring *et al.* 1992; Tove 1995; Waring *et al.* 2001; Hamazaki 2002; Palka 2006). 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; MacLeod *et al.* 2006; Jefferson et al. 2008). It is considered rare in Canadian waters (Houston 1990).

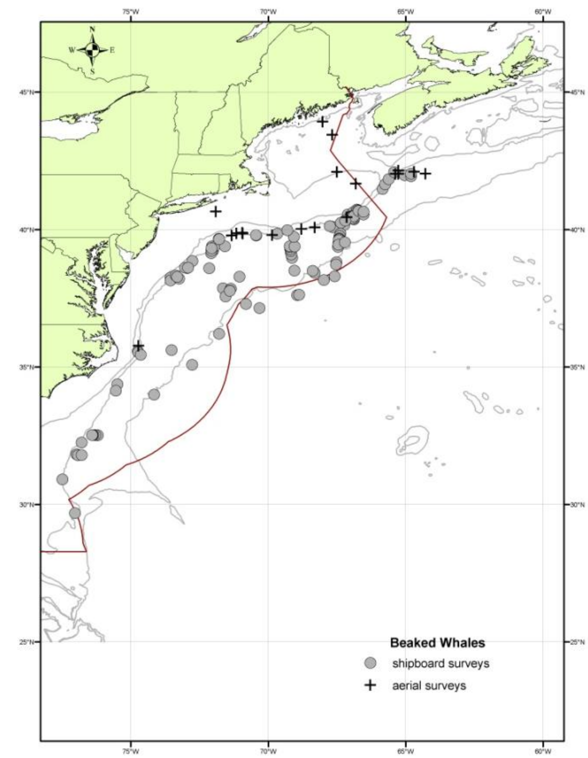

Figure 1: *NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004~~, and~~ 2006, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

POPULATION SIZE

The total number of True's beaked whales off the eastern U.S. and Canadian Atlantic coast is unknown, and seasonal abundance estimates are not available for this stock. However, several estimates of the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) from selected regions are available for select time periods (Barlow *et al.* 2006). Sightings are almost exclusively in the continental shelf edge and continental slope areas (Figure 1). ~~The best 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 =0.578), 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.~~

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.~~

Recent surveys and abundance estimates

~~An abundance estimate of 822 (CV=0.81) undifferentiated beaked whales was obtained from an aerial survey conducted in July and August 2002 which covered 7,465 km of trackline over waters from the 1000 m depth contour on the southern edge of Georges Bank to Maine (Table 1; Palka 2006). The value of g(0) used for this estimation was derived from the pooled data of 2002, 2004 and 2006 aerial survey data.~~

An abundance of 2,839 (CV=0.78) 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 (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two independent team line-transect method and analyzed using the modified direct duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and g(0), the probability of detecting a group on the track line. Aerial data were collected using the Hiby circle-back line transect method (Hiby 1999) and analyzed accounting for g(0) and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths > 50m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August, 2004. The survey employed two independent visual teams searching with 25× bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf S~~s~~tream front in the ~~Mid-Atlantic~~mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for beaked whales between Florida and Maryland was 674 animals (CV =0.36*).*

An abundance estimate of 922 (CV=1.47) undifferentiated beaked whales was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000 m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; Palka pers. comm.)

No beaked whales ~~sightings~~ were identified as True's beaked whales during a shipboard and aerial abundance survey conducted during June-August 2011. The aerial portioned covered 6,850 km of tracklines that were over waters ~~from Massachusetts to New Brunswick, Canada (waters~~ north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy~~)~~. The shipboard portioned covered 3,811 km of tracklines that were in waters offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). In addition, an abundance survey was conducted concurrently in the southern US waters (from North Carolina to Florida)~~;~~. The abundance estimates from this southern survey are being calculated and are not available at this time.

Although the 1990-2011~~2006~~ 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 1990-2011~~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. NMFS survey results ~~Recent results~~ suggest that beaked whale abundance may be highest in association with Gulf Stream and warm-core ring features (Waring *et al*. 2001, Hamazaki 2002).

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 *Ziphius* and *Mesoplodon* 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
~~Aug 2002~~	~~Georges Bank to Maine coast~~	~~822~~	~~0.81~~
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
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	922	1.47

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for this stock. ~~The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 3,513 (CV =0.63) and the minimum population estimate is 2,154. It is not possible to determine the minimum population estimate of only True's beaked whales.~~

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. *Mesoplodon* spp. 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 5.5 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 (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"~~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"~~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. PBR for the western North Atlantic stock of True's beaked whales is unknown because the minimum population size is unknown. ~~0.4 because the CV for the fishery mortality estimate exceeds 0.8. PBR for all species in the undifferentiated complex of beaked whales (*Ziphius* and *Mesoplodon* spp.) is 17. It is not possible to determine the PBR for only *Mesoplodon* beaked whales.~~

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The 2006-2010~~2003-2007~~ total average estimated annual mortality of True's beaked whales in observed fisheries in the U.S. Atlantic EEZ is zero.~~1.2 and is derived from two components: 1) estimated average annual fishery bycatch of one animal from observed fisheries (Table 2), and 2) one stranded animal entangled in fishing gear (Table 3).~~

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.

Estimated annual average fishery-related mortality or serious injury of this stock in 2006-2010~~2003-2007~~ in ~~the~~ U.S. fisheries was zero. ~~listed below was 1 beaked whale (CV=1.0)(Table 1).~~ 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 prior to 2003 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) has been used to determine species identifications for some of the bycaught animals. Estimates from the 1989 to 1993 period 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). Estimates of bycatch mortality by species are available for the 1994-1998 period. For animals identified as True's beaked whales, bycatch estimates were 0 in 1994, 1 (0) in 1995, 2 (0.26) in 1996 and 2 (0) in 1998. Estimated annual fishery-related mortality for unidentified *Mesoplodon* beaked whales during this period was 0 in 1994, 3 (0) in 1995, 2 (0,25) in 1996, and 7 (0) in 1998. There was no fishery during 1997. During July 1996, one beaked whale was entangled and released alive with "gear in/around a single body part".

~~Pelagic Longline~~

One unidentified beaked whale was seriously injured in the U.S. Atlantic pelagic longline fishery in 2003. This interaction occurred in the Sargasso Sea fishing area. The estimated fishery-related combined mortality in 2003 was 5.3 beaked whales (CV=1.0). No serious injury or mortality interactions were reported prior to 2003 or in 2004 - 2010~~2007~~. The estimated average combined mortality in 2006-2010~~2003-2007~~ was zero~~1~~ beaked whales. ~~(CV=1.0)(Table 2).~~

~~Table 2. Summary of the incidental mortality of Beaked Whales (*Ziphius cavirostris* and *Mesoplodon* sp.) 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 (excluding NED-E)~~ [b,c]	~~03-07~~	~~63, 60, 60, 63,62~~	~~Obs. Data Logbook~~	~~.09, .09, .06, .07, .08~~	~~1, 0, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~05.3, 0, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~5.3, 0, 0, 0, 0~~	~~1.0, 0, 0, 0, 0~~	~~1(1.0)~~
~~TOTAL~~											~~1 (1.0)~~

~~a Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).~~

~~b 2003 SI estimates were taken from Table 10 in Garrison and Richards (2004).~~

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

Other Mortality

During 2006-2010, two True's beaked whales stranded along the U.S. Atlantic coast (Table 3). Neither of these animals showed evidence of a human interaction.~~From 1992-2002, a total of 69 beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). This includes: 38 (includes one tentative identification) Gervais' beaked whales (one 1997 animal and one 2002 animal had plastics in stomach; 2 animals that stranded in September 1998 in South Carolina showed signs of fishery interactions; one Florida 2001 animal showed signs of blunt trauma; one 2002 animal may have been involved in a ship strike); 3 True's beaked~~

whales; 6 Blainville's beaked whales; 1 Sowerby's beaked whale; 14 Cuvier's beaked whales (one 1996 animal had propeller marks, and one 2000 animal had a longline hook in the lower jaw) and 7 unidentified animals.

From 1992-2010, a total of 123 beaked whales stranded along the U.S. Atlantic coast between Florida and Massachusetts (NMFS unpublished data). This includes: 61 (includes one tentative identification) Gervais' beaked whales (one 1997 animal and one 2002 animal had plastics in their stomach; 2 animals that stranded in September 1998 in South Carolina showed signs of fishery interactions; one Florida 2001 animal showed signs of blunt trauma; one 2002 animal may have been involved in a ship strike); 7 True's beaked whales (one in 2003 that stranded in Virginia was entangled in fishing gear); 14 Blainville's beaked whales (one in 2007 that stranded in South Carolina was classified as a fishery interaction); 5 Sowerby's beaked whales (one in 2003 that stranded in Maine was likely killed by a boat strike); 27 Cuvier's beaked whales (one 1996 animal had propeller marks; one 2000 animal had a longline hook in the lower jaw; one in 2005 that stranded in Georgia had plastic debris in the stomach; one in 2007 in South Carlonia that displayed signs of a boat strike; and one in 2008 that stranded in New Jersey had net and wood fragments in the GI tract) and 9 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, sSeveral unusual mass strandings of beaked whales throughout their worldwide range have been associated with naval activities activities (D'Amico et al. 2009; Filadelfo et al. 2009. During the mid- to late 1980's 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 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; A'Amico et al. 2009; Filadelfo et al. 2009). 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; NMFS 2001; Cox *et al.* 2006). 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.* 2006). Ocean Conservation Research has assembled a partial list of cetacean strandings, mostly beaked whales, that may have been associated with military-generated noise. (http://ocr.org/research/impacts/military-associated-strandings.pdf, accessed 21 Oct 2009). Fourteen beaked whales (mostly Cuvier's beaked whales but also including Gervais' and Blainville's beaked whales) stranded in the Canary Islands in 2002 (Cox *et al.* 2006, Fernandez *et al.* 2005; Martin *et al.* 2004). Gas bubble-associated lesions and fat embolism were found in necropsied animals from this event, leading researchers to link nitrogen supersaturation with sonar exposure (Fernandez *et al.* 2005).

During 2006-20102003-2007, two four True's beaked whales and two unidentified *Mesoplodon* whales stranded along the U.S. Atlantic coast (Table 3). None of One of these animals was classified as a fisheries showed evidenc of a human interaction.

Table 3. True's beaked whale (*Mesoplodon mirus*) strandings along the U.S. Atlantic coast.

State	2006	2007	2008	2009	2010	Total
New Jersey	0	1	0	0	0	1
New York	0	1	0	0	0	1
Total	**0**	**2**	**0**	**0**	**0**	**2**

Table 3. True's beaked whale (*Mesoplodon mirus*) strandings along the U.S. Atlantic coast.

State	2003	2004	2005	2006	2007		Total
					M. mirus	*Mesoplodon spp.*	
Rhode Island						1	1
New Jersey					1		1
New York					1		1
Virginia[a]	1						1
North Carolina	1					1	2
Total	2	0	0	0	2	2	6

[a] Entanglement in fishing gear was the likely cause of death for 2003 animal.

STATUS OF STOCK

The western North Atlantic stock of True's beaked whale is not a strategic stock. The status of True's beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. This 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. Although a species specific PBR cannot be determined, tThe permanent closure of the pelagic drift gillnet fishery has eliminated the principal known source of incidental fishery mortality,. and no fishery-related mortality and serious injury has been observed during the recent 5-year (2006-2010) period. Ttherefore, total U.S. fishery-related mortality and serious injury rate can be considered to be insignificant and approaching zero mortality and serious injury rate. The status of True's beaked whales relative to OSP in U.S. Atlantic EEZ is unknown. This species is not listed as threatened or endangered under the Endangered Species Act. The total U.S. fishery mortality and serious injury for this group of species 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. because average annual human-related mortality and serious injury does not exceed PBR.

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RISSO'S DOLPHIN (*Grampus griseus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Risso's dolphins are distributed worldwide in tropical and temperate seas (Jefferson et al. 2008), and in the Northwest Atlantic occur from Florida to eastern Newfoundland (Leatherwood et al. 1976; Baird and Stacey 1991). Off the northeast U.S. coast, Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and autumn (CETAP 1982; Payne et al. 1984). In winter, the range is in the mid-Atlantic Bight and extends outward into oceanic waters (Payne et al. 1984). In general, the population occupies the mid-Atlantic continental shelf edge year round, and is rarely seen in the Gulf of Maine (Payne et al. 1984). During 1990, 1991 and 1993, spring/summer surveys conducted along the continental shelf edge and in deeper oceanic waters sighted Risso's dolphins associated with strong bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Waring et al. 1992, 1993; Hamazaki 2002). There is no information on stock structure of Risso's dolphin in the western North Atlantic, or to determine if separate stocks exist in the Gulf of Mexico and Atlantic. [Therefore, it is plausible the stock could actually contain multiple demographically independent populations that should themselves be stocks, because the current stock spans multiple eco-regions (Llonghurst 1998; Spalding et al. 2007).] In 2006, a rehabilitated adult male Risso's dolphin stranded and released in the Gulf of Mexico off Florida was tracked via satellite to waters off Delaware (Wells et al. 2009). The Gulf of Mexico –and Atlantic stocks are currently being treated as two separate stocks.

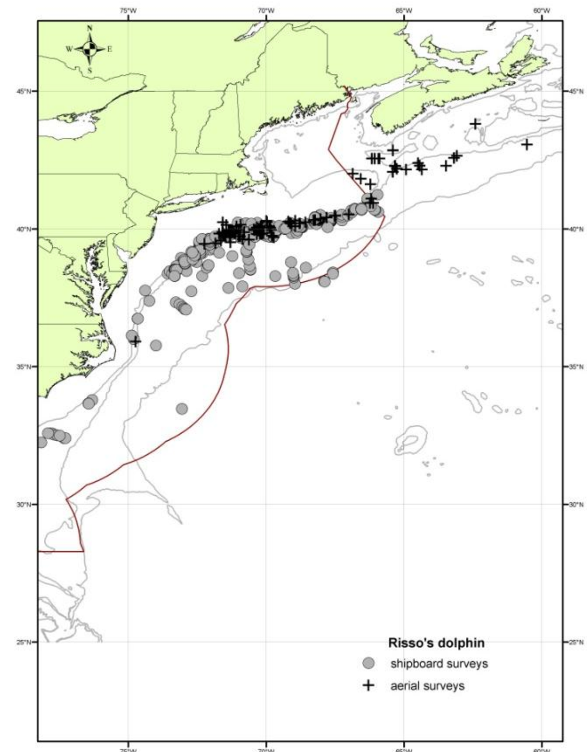

Figure 1. *Distribution of Risso's dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004-, 2006, and 2007, 2008 and 2010. Isobaths are the 100-m, 1,000-m, and 4,000-m depth contours.*

POPULATION SIZE

Total numbers of Risso's dolphins off the U.S. or Canadian Atlantic coast are unknown, although eight Nine abundance estimates are available for Risso's dolphins from selected regions for select time periods. Sightings were almost exclusively in continental shelf edge and continental slope areas (Figure 1). The best abundance estimate for Risso's dolphins is the result of the 2011 survey—sum of the estimates from the two 2004 U.S. Atlantic surveys, 17,734 (CV= 0.42)20,479 (CV=0.59), where the estimate from the northern U.S. Atlantic is 15.053 (CV=0.78), and from the southern U.S. Atlantic is 5,426 (CV=0.54). This joint estimate is considered best because these two surveys together have the most complete coverage of the population's habitat.

Earlier abundance estimates

Please see ~~a~~Appendix IV for a summary of abundance estimates, including earlier ~~abundance esti~~estimates and survey descriptions.

~~. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, therefore should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates.~~

Recent surveys and abundance estimates

An abundance estimate of 15,054 (CV=0.78) Risso's dolphins was obtained 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 (38ºN) to the Bay of Fundy (45ºN) (Table 1; Palka 2006). Shipboard data were collected using the two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001) , and *g(0)*, the probability of detecting a group on the track-line. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).

A shipboard survey of the U.S. Atlantic outer continental shelf and continental slope (water depths >50 m) between Florida and Maryland (27.5 and 38ºN latitude) was conducted during June-August 2004. The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the mid-Atlantic. The survey included 5,659 km of trackline, and recorded 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 Risso's dolphins between Florida and Maryland was 5,426 (CV =0.54).

An abundance estimate of 14,408 (CV=0.38) Risso's dolphins was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2,000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka, pers. comm.). The value of g(0) used for this estimation was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 17,734 (CV= 0.42) Risso's dolphins was generated from a shipboard and aerial survey conducted during June - August 2011. The aerial portion covered 6,850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). An abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.

Table 1. Summary of abundance estimates for the western North Atlantic Risso's dolphin. Month, year, and area covered during each abundance survey, resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV

Jun-Aug 2004	Maryland to Bay of Fundy	15,053	0.78
Jun-Aug 2004	Florida to Maryland	5,426	0.54
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	20,479	0.59
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	14,408	0.38
Jun-Aug 2011	North Carolina to lower Bay of Fundy	17,734	0.42

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for Risso's dolphins is 20,47917,734 (CV=0.5942), obtained from the 2004 2011 surveys. The minimum population estimate for the western North Atlantic Risso's dolphin is 12,92012,6302,593,121.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery"recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 12,9202,593.12,630. The maximum productivity rate is 0.04, the default value for cetaceans (Barlow *et al.* 1995). The "recovery"recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.48 because the CV of the average mortality estimate is between 0.3 and 0.6 (Wade and Angliss 1997). PBR for the western North Atlantic stock of Risso's dolphin is 1241241.

ANNUAL HUMAN-CAUSED MORTALITY

Total annual estimated average fishery-related mortality or serious injury to this stock during 2006-2010 was XX17 Risso's dolphins (CV=0.5142; Table 2). 2005-2009 was 18 Risso's dolphins (CV=0.37; Table 2).

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

Prior to 1977, there was no documentation of marine mammal bycatch in distant-water fleet (DWF) activities off the northeast coast of the U.S. With implementation of the Fisheries Conservation and Management Act in that year, an observer program was established which recorded fishery data and information on incidental bycatch of marine mammals. NMFS foreign-fishery observers reported four deaths of Risso's dolphins incidental to squid and mackerel fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring et al. 1990; NMFS unpublished data).

In the pelagic drift gillnet fishery 51 Risso's dolphin mortalities were observed between 1989 and 1998. One animal was entangled and released alive. Bycatch occurred during July, September and October along continental shelf edge canyons off the southern New England coast. Estimated annual mortality and serious injury (CV in parentheses) attributable to the drift gillnet fishery was 87 in 1989 (0.52), 144 in 1990 (0.46), 21 in 1991 (0.55), 31 in 1992 (0.27), 14 in 1993 (0.42), 1.5 in 1994 (0.16), 6 in 1995 (0), 0 in 1996, no fishery in 1997, and 9 in 1998 (0).

This fishery was closed effective in 1999.

In the pelagic pair trawl fishery, one mortality was observed in 1992. Estimated annual fishery-related mortality (CV in parentheses) attributable to the pelagic pair trawl fishery was 0.6 dolphins in 1991 (1.0), 4.3 in 1992 (0.76), 3.2 in 1993 (1.0), 0 in 1994 and 3.7 in 1995 (0.45). This fishery ended as of 1996.

In the northeast sink gillnet fishery, Rissso's dolphin interactions were observed in 2000, 2005 and 2006. Estimated annual mortalities (CV in parentheses) from this fishery are: 0 in 1999, 15 (1.06) in 2000, 0 in 2001-2004, 15 in 2005 (0.93), and 0 in 2006 through 2010.

Pelagic Longline

Pelagic longline bycatch estimates of Risso's dolphins in 1998, 1999, and 2000 were obtained from Yeung (1999), Yeung *et al.* (2000), and Yeung (2001), respectively. Bycatch estimates for 2001 - 2009 were obtained from Garrison (2003), Garrison and Richards (2004), Garrison (2005), Fairfield *et al.* ~~Walsh and Garrison~~ (2006, 2007), ~~Fairfield Walsh and Garrison (2007)~~, Fairfield and Garrison (2008), ~~(~~Garrison *et al.* (2009), ~~and~~ (Garrison and Stokes (2010), and Garrison and Stokes (2011). Most of the estimated marine mammal bycatch was from U.S. Atlantic EEZ waters between South Carolina and Cape Cod. Excluding the Gulf of Mexico, from 1992 to 2000 one mortality was observed in both 1994 and 2000, and 0 in other years. The observed numbers of seriously-injured but released alive individuals from 1992 to 2010~~2008~~ were, respectively, 2, 0, 6, 4, 1, 0, 1, 1, 1, 6, 4, 2, 2, 0, 0, 1, 2, 2 and 0~~and 3 (Cramer 1994; Scott and Brown 1997; Johnson *et al.* 1999; Yeung 1999; Yeung *et al.* 2000; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield Walsh and Garrison 2007; Fairfield and Garrison 2008) (Table 2).~~ Estimated annual fishery-related mortality (CV in parentheses) was 17 animals in 1~~1~~994 (1.0), 41 in 2000 (1.0), 24 in 2001(1.0), 20 in 2002 (0.86), and 0 in 2003 to 2008 (Table 2). Seriously injured and released alive animals were estimated to be 54 dolphins (0.7) in 1992, 0 in 1993, 120 (0.57) in 1994, 103 (0.68) in 1995, 99 (1.0) in 1996, 0 in 1997, 57 (1.0) in 1998, 22 (1.0) in 1999, 23 (1.0) in 2000, 45 (0.7) in 2001, 8 (1.0) in 2002, 40 (0.63) in 2003 28(0.72) in 2004, 3(1.0), 0 in 2005, 0 in 2006, 9 in 2007, ~~and~~ 17 in 2008, 11 (0.71) in 2009, and 0 in 2010. ~~(Table 2).~~ There is a high likelihood that dolphins released alive with ingested gear or gear wrapped around appendages will not survive (Wells *et al.* 2008~~a~~). The annual average combined mortality and serious injury for 2006-2010 ~~2005-2009 is 8~~ is 7.4 Risso's dolphins (CV =0.71~~43~~0; Table 2).

~~**Northeast Sink Gillnet**~~

~~Estimated annual mortalities (CV in parentheses) from this fishery are: 0 in 1999, 15 (1.06) in 2000, 0 in 2001-2004, 15 in 2005 (0.93), and 0 in 2006 through 2009 (Table 2). The 2005-2009 average mortality in this fishery is 3 Risso's dolphins (CV =0.93).~~

~~Mid-Atlantic~~mid-Atlantic Bottom Trawl

Fifteen Risso's dolphins were observed taken in mid-Atlantic bottom trawl fisheries in 2010 (Table 2). This is the first time this species was observed taken in this fishery. The estimated annual fishery-related mortality and serious injury attributable to the ~~Mid-Atlantic~~mid-Atlantic ~~northeast~~ bottom trawl fishery (CV in parentheses) are 0 in 2006, 0 in 2007, 0 in 2008, and 0 in 2009. T~~but has not yet been calculated for~~he 2010 estimate is currently not available. Until this bycatch estimate can be developed, the ~~The~~ 2006-2010 average annual mortality attributed to the mid-Atlantic bottom trawl is calculated as 3 animals (15 animals/5 years).

~~Mid-Atlantic~~mid-Atlantic Gillnet

A Risso's dolphin mortality was observed in this fishery for the first time in 2007. The resulting estimated annual mortality for 2007 was 34 (CV=0.73). The ~~2005~~2006-~~2009~~ 2010 average mortality in this fishery is 6.4~~7~~ Risso's dolphins (CV=0.73).

~~Mid-Atlantic~~mid-Atlantic Mid-water Trawl

A Risso's dolphin mortality was observed in this fishery for the first time in 2008, and not again since. No bycatch estimate has been generated. Until this bycatch estimate can be developed, the 2006-2010 average annual mortality attributed to the mid-Atlantic midwater trawl is calculated as 0.2 animals (1 animal/5 years).

Table 2. Summary of the incidental mortality of Risso's dolphin (*Grampus griseus*) by commercial fishery including the years sampled (Years), 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	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]	0~~5~~6-~~09~~10	Obs. Data Logbook	~~.06~~, .07, .07, .07, .14, .08	~~0,~~ 0, 1, 2, 2, 0	0, 0, 0, 0, 0	~~3,~~ 0, 9, 17, 11, 0	0, 0, 0, 0. 0	~~3,~~ 0, 9, 17, 11, 0	~~1,~~ 0, .65, .73, .71, 0	~~8~~7.4 (0.~~47~~~~10~~~~3~~)
~~Northeast Sink Gillnet~~	~~05-09~~	~~Obs. Data Trip Logbook, Allocated Dealer Data~~	~~04, .07, .05, .04~~	~~0, 0, 0, 0, 0~~	~~1, 0, 0, 0, 0~~	~~0, 0, 0, 0, 0~~	~~15, 0, 0, 0, 0~~	~~15, 0, 0, 0, 0~~	~~0.93, 0, 0, 0, 0~~	~~3 (0.93)~~
~~Mid-Atlantic~~mid-Atlantic Gillnet	~~05~~06-~~09~~10	Obs. Data, Trip Logbook, Allocated Dealer Data	~~.03,~~ .04, .04, .03, .03	0, 0, 0, 0, 0	~~0,~~ 0, 1, 0, 0, 0	0, 0, 0, 0, 0	~~0,~~ 0, 34, 0, 0, 0	~~0,~~ 0, 33, 0, 0, 0	~~0,~~ 0, .73, 0, 0, 0	6.6~~7~~ (0.73)
~~Mid-Atlantic~~mid-Atlantic Bottom Trawl [~~d~~c]	06-10	Obs. Data Dealer	.02, .03, .03. .05, .06	0, 0, 0, 0 , 0	0, 0, 0, 0, 15	0, 0, 0, 0 , 0	0, 0, 0, 0, na	0, 0, 0, 0, na	0, 0, 0, 0, na	3 (na)
~~Mid-Atlantic~~mid-Atlantic Midwater Trawl - Including Pair Trawl [c]	~~05~~06-~~09~~10	Obs. Data Weighout Trip Logbook	~~.084,~~ .089, .039, .133, .132, .25	0,0,0,0,0	~~0,~~0,0,1,0, 0	na	na	na	na	~~na~~0.2 (na)
TOTAL										~~18~~ 17.2 (0.~~37~~51~~42~~)

[a] Observer data (Obs. Data) are used to measure bycatch rates and the data are collected within the Northeast Fisheries Observer Program. The Observer Program collects landings data (Weighout), and total landings are used as a measure of total effort for the coastal gillnet fishery. Total observer coverage reported for gillnet and bottom trawl gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery at-sea monitors through the Northeast Fisheries Observer Program (NEFOP). For 2010 only the NEFOP observed data were reported in this table, since the at-sea monitoring program just started in May 2010. In the Northeast region 437 and 658 trawl trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 trawl trips were sampled by observers and monitors, respectively.

[b] Estimates can include data pooled across years, so years without observed SI or Mortality may still have an estimated value.

[c] Estimates have not been generated for bottom trawl or midwater trawl. Unexpanded values are provisionally provided.

Other mortality

From 2006-2010, ~~2005 to 2009, 66~~ 43 Risso's dolphin strandings were recorded along the U.S. Atlantic coast (NMFS unpublished data). ~~Six~~ Seven animals during this time period had indications of human interaction, ~~four~~

three of which were fishery interactions. Indications of human interaction are not necessarily the cause of death (Table 3). In eastern Canada, one Risso's dolphin stranding was reported on Sable Island, Nova Scotia from 1970 to1998 (Lucas and Hooker 2000).

A Virginia Coastal Small Cetacean Unusual Mortality Event (UME) occurred along the coast of Virginia from 1 May to 31 July 2004, when 66 small cetaceans, including one Risso's dolphin, stranded mostly along the outer (eastern) coast of Virginia's barrier islands.

A Mid-Atlanticmid-Atlantic Offshore Small Cetacean UME was declared when 33 small cetaceans stranded from Maryland to Georgia between July and September 2004. The species involved are generally found offshore and are not expected to strand along the coast. Three Risso's dolphins were involved in this UME.

Table 3. Risso's dolphin (*Grampus griseus*) reported strandings along the U.S. Atlantic coast, 2005-2009.

STATE	2005	2006	2007	2008	2009	TOTALS
Maine	-	1	-	1	1	3
Massachusetts[a,d]	8	1	3	8	4	24
Rhode Island	1	-	-	-	-	1
New York	4	1	-	-	-	5
New Jersey	5	-	2	-	-	7
Delaware	1	-	1	-	-	2
Maryland	2	1	-	1	1	5
Virginia[b]	4	1	1	-	2	8
North Carolina[c]	2	1	-	1	3	7
Georgia	-	-	-	-	1	1
Florida[e]	-	-	1	-	2	3
TOTAL	27	6	8	11	14	66

a. One of the 2009 animals had propeller wounds.

b. One of the 2005 animals showed signs of fishery interaction. One of the 2009 animals showed signs of human interaction.

c. One animal in 2006 and 2 in 2009 showed signs of fishery interaction.

d. 2008 includes 4 animals mass stranded in Massachusetts, 3 of which were released alive.

e. The 2 animals in 2009 were considered a mass stranding.

Table 3. Risso's dolphin (*Grampus griseus*) reported strandings along the U.S. Atlantic coast, 2006-2010.

STATE	2006	2007	2008	2009	2010	TOTALS
Maine	1	0	1	0	0	2
Massachusetts[a,d]	1	3	8	4	0	16
New York	1	0	0	0	0	1
New Jersey	0	2	0	1	0	3
Delaware	0	1	0	0	0	1
Maryland	1	0	1	0	1	3
Virginia[b]	1	1	0	2	4	8
North Carolina[c]	1	0	1	3	2	7

Georgia	0	0	0	1	0	1
Florida	0	1	0	0	0	1
TOTAL	6	8	11	11	7	43

a. One of the 2009 animals had propeller wounds.

b. One of the 2009 animals showed signs of human interaction.

c. One animal in 2006 and 2 in 2009 showed signs of fishery interaction. One animal in 2008 and one in 2010 were classified as human interaction.

d. 2008 includes 4 animals mass stranded in Massachusetts, 3 of which were released alive.

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 2006-2010 average annual human-related mortality does not exceed PBR; therefore, this is not a strategic stock. The total U.S. fishery 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 a zero mortality and serious injury rate. The status of Risso's dolphins relative to OSP in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine population trends for this species. The species is not listed as threatened or endangered under the Endangered Species Act. ~~There are insufficient data to determine population trends for this species. The total U.S. fishery 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 a zero mortality and serious injury rate. The~~ 2006-2010 ~~2005-2009 average annual human-related mortality does not exceed PBR; therefore, this is not a strategic stock.~~

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ATLANTIC WHITE-SIDED DOLPHIN (*Lagenorhynchus acutus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

White-sided dolphins are found in temperate and sub-polar waters of the North Atlantic, primarily in continental shelf waters to the 100-m depth contour. In the western North Atlantic the species inhabits waters from central West Greenland to North Carolina (about 35˚N) and perhaps as far east as 29˚W in the vicinity of the mid-Atlantic Ridge (Evans 1987; Hamazaki 2002; Doksaeter *et al.* 2008; Waring *et al.* 2008). Distribution of sightings, strandings and incidental takes suggest the possible existence of three stock units: Gulf of Maine, Gulf of St. Lawrence and Labrador Sea stocks (Palka *et al.* 1997). Evidence for a separation between the population in the southern Gulf of Maine and the Gulf of St. Lawrence population comes from a virtual absence of summer sightings along the Atlantic side of Nova Scotia. This was reported in Gaskin (1992), is evident in Smithsonian stranding records, and was obvious during abundance surveys conducted in the summers of 1995, and 1999 and 2004, which covered waters from Virginia to the Gulf of St. Lawrence and during the Canadian component of the TNASS survey in the summer of 2007 (Lawson and Gosselin 2009). White-sided dolphins were seen frequently in Gulf of Maine waters and in waters at the mouth of the Gulf of St. Lawrence, but only a few sightings were recorded between these two regions.

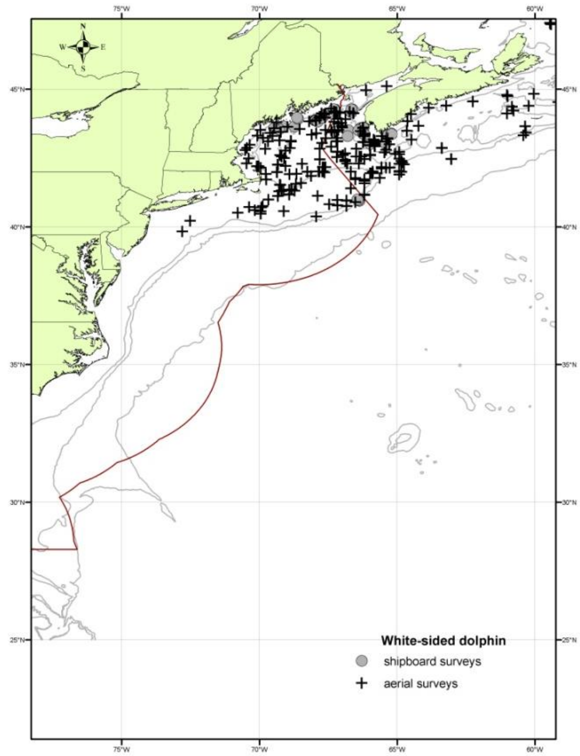

Figure 1. *Distribution of white-sided dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006 and, 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

The Gulf of Maine population of white-sided dolphins is most common in continental shelf waters from Hudson Canyon (approximately 39˚N) on to Georges Bank, and in the Gulf of Maine and lower Bay of Fundy. Sightings data indicate seasonal shifts in distribution (Northridge *et al.* 1997). During January to May, low numbers of white-sided dolphins are found from Georges Bank to Jeffreys Ledge (off New Hampshire), with even lower numbers south of Georges Bank, as documented by a few strandings collected on beaches of Virginia and North Carolina. From June through September, large numbers of white-sided dolphins are found from Georges Bank to the lower Bay of Fundy. From October to December, white-sided dolphins occur at intermediate densities from southern Georges Bank to southern Gulf of Maine (Payne and Heinemann 1990). Sightings south of Georges Bank, particularly around Hudson Canyon, occur year round but at low densities. The Virginia and North Carolina observations appear to represent the southern extent of the species' range during the winter months. The seasonal spatial distribution of this species appears to be changing during the last few years. -These spatial-temporal patterns are currently being investigated to document the magnitude of these apparent changes.

Recent stomach content analysis of both stranded and incidental caught white-sided dolphins in U.S. waters, determined that the predominant prey were silver hake (*Merluccius bilinearis*), spoonarm octopus (*Bathypolypus bairdii*), and haddock (*Melanogrammus aeglefinus*). Sand lances (*Ammodytes* spp.) were only found in the stomach of one stranded *L. acutus*. Seasonal variation in diet was indicated; pelagic Atlantic herring (*Clupea harengus*) was the most important prey in summer, but was rare in winter (Craddock *et al.* 2009).

POPULATION SIZE

~~The total number~~Abundance estimates of white-sided dolphins ~~along the eastern U.S. and Canadian Atlantic coast is unknown, although estimates from select regions~~from various portions of their range are available from: spring, summer and autumn 1978-1982; July-September 1991-1992; June-July 1993; July-September 1995; July-August 1999; August 2002; June-July 2004; August 2006; and July-August 2007. The best available current abundance estimate for white-sided dolphins in the western North Atlantic stock is the result of the 2011 survey—45,592 (CV= 0.54)~~51,478 (CV=0.36)~~. However, because of the apparent changes in the seasonal distribution of this species, the best available abundance estimate may come from one of the non-summer abundance surveys that will be conducted in 2011-2012.

~~23,390 (CV=0.23), the sum of the 2006 and 2007 surveys. While the combined estimate may include a certain amount of inter-annual redistribution, it is still felt to be the more representative than either estimate alone.~~

Earlier abundance estimates

Please see Appendix IV for earlier abundance estimates. ~~As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), if estimates are older than eight years PBR is undetermined.~~

Recent surveys and abundance estimates

An abundance estimate of 2,330 (CV=0.80) white-sided dolphins was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 6,180 km of trackline from the 100-m depth contour on southern Georges Bank to the lower Bay of Fundy. The Scotian shelf south of Nova Scotia was not surveyed (Table 1). 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 trackline. Aerial data were collected using the Hiby circle-back line- transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of aerial g(0) was derived from the pooled 2002, 2004 and 2006 aerial survey data.

An abundance estimate of 17,594 (CV=0.30) white-sided dolphins was generated from an aerial survey conducted in August 2006 that surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. Data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005). The value of g(0) was derived from the pooled 2002, 2004 and 2006 aerial survey data (Table 1; NMFS 2006).

An abundance estimate of 24,422 (CV=0.49~~5,796 (95%CI=2,681-13,088)~~ white-sided dolphins was generated from the Canadian Trans-North Atlantic Sighting Survey ~~(TNASS)~~ in July-August 2007. This aerial survey covered area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast (Lawson and Gosselin 2009). -The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (M~~C~~RDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (2007) analysis method (Lawson and Gosselin 2011).~~Estimates from this survey have not yet been corrected for availability and perception biases (Lawson and Gosselin 2009).~~

An abundance estimate of 45,592 (CV=~~-~~0.54) white-sided dolphins was generated from a shipboard and aerial survey conducted during Jun~~--~~-Aug 2011. The aerial portion~~ed~~ covered 6,850 km of tracklines that were over waters ~~from Massachusetts to New Brunswick, Canada (waters~~ north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy~~)~~. The shipboard portion~~ed~~ covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the ~~mark-recapture distance sampling (~~MRDS~~)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of recent abundance estimates for western North Atlantic stock of white-sided dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).			
Month/Year	Area	N_{best}	CV
Jun-Jul 2004	Gulf of Maine to lower Bay of Fundy	2,330	0.80
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	17,594	0.30
Jul-Aug 2007	N. Labrador to Scotian Shelf	~~5,796~~24,422	0.~~43~~49
~~2006 and 2007~~	~~Sum of 2006 and 2007 surveys~~	~~23,390~~	~~0.23~~
2011	North Carolina to lower Bay of Fundy	45,592	0.54

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for the western North Atlantic stock of white-sided dolphins is ~~23,390~~45,592 (CV=0~~.23~~.54). The minimum population estimate for these white-sided dolphins is ~~19,019~~29,806~~34,454~~.

Current Population Trend

A trend analysis has not been conducted for this species.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. Life history parameters that could be used to estimate net productivity include: calving interval is 2-3 years; lactation period is 18 months; gestation period is 10-12 months and births occur from May to early August, mainly in June and July; length at birth is 110 cm; length at sexual maturity is 230-240 cm for males, and 201-222 cm for females; age at sexual maturity is 8-9 years for males and 6-8 years for females; mean adult length is 250 cm for males and 224 cm for females (Evans 1987); and maximum reported age for males is 22 years and for females, 27 years (Sergeant *et al.* 1980).

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~“recovery”~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 19,019. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~“recovery”~~recovery factor, which accounts for endangered, depleted, threatened, or stocks of unknown status relative to optimum sustainable population (OSP) is assumed to be 0.5 because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic stock of white-sided dolphin is ~~190~~298~~345~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during ~~2005~~2006-~~2009~~ 2010 was ~~2227~~213~~45~~ (CV=0.1~~6~~3~~2~~) white-sided dolphins (Table 2).

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

NMFS observers in the Atlantic foreign mackerel fishery reported 44 takes of Atlantic white-sided dolphins incidental to fishing activities in the continental shelf and continental slope waters between March 1977 and December 1991 (Waring *et al.* 1990; NMFS unpublished data). Of these animals, 96% were taken in the Atlantic mackerel fishery. This total includes 9 documented takes by U.S. vessels involved in joint-venture (JV) fishing operations in which U.S. captains transfer their catches to foreign processing vessels. No incidental takes of white-sided dolphins were observed in the Atlantic mackerel JV fishery when it was observed in 1998.

During 1991 to 1998, two white-sided dolphins were observed taken in the Atlantic pelagic drift gillnet fishery, both in 1993. Estimated annual fishery-related mortality and serious injury (CV in parentheses) was 4.4 (.71) in 1989, 6.8 (.71) in 1990, 0.9 (.71) in 1991, 0.8 (.71) in 1992, 2.7 (0.17) in 1993 and 0 in 1994, 1995, 1996, and 1998. There was no fishery during 1997 and the fishery was permanently closed in 1999.

A U.S. JV mid-water (pelagic) trawl fishery was conducted during 2001 on Georges Bank from August to December. No white-sided dolphins were incidentally captured. Two white-sided dolphins were incidentally captured in a single mid-water trawl during foreign fishing operations (TALFF). During TALFF fishing operations all nets fished by the foreign vessel are observed. The total mortality attributed to the Atlantic herring JV and TALFF mid-water trawl fisheries in 2001 was two animals.

The mid-Atlantic gillnet fishery occurs year round from New York to North Carolina and has been observed since 1993. One white-sided dolphin was observed taken in this fishery during 1997. None were observed taken in other years. The estimated annual mortality (CV in parentheses) attributed to this fishery was 0 for 1993 to 1996, 45 (0.82) for 1997, 0 for 1998 to 2001, unknown in 2002 and 0 in 2003-~~2009~~2010.

Three white-sided dolphins were observed taken in northeast mid-water paired trawls. Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001-2002, 22 (0.97) in 2003, 0 in 2004, 9.4 (1.03) in 2005, and 0 in 2006 to 2010.

U.S.

Northeast Sink Gillnet

Estimated annual white-sided dolphin mortalities (CV in parentheses) attributed to the Northeast sink gillnet fishery were 49 (0.46) in 1991, 154 (0.35) in 1992, 205 (0.31) in 1993, 240 (0.51) in 1994, 80 (1.16) in 1995, 114 (0.61) in 1996 (Bisack 1997), 140 (0.61) in 1997, 34 (0.92) in 1998, 69 (0.70) in 1999, 26 (1.00) in 2000, 26 (1.00) in 2001, 30 (0.74) in 2002, 31 (0.93) in 2003, 7 (0.98) in 2004, 59 (0.49) in 2005, 41 (0.71) in 2006, 0 in 2007, 81 (0.57) in 2008, ~~and~~ 0 in 2009, and ~~143~~75 (0.87) in 2010. Average annual estimated fishery-related mortality during ~~2005~~2006-~~2009~~ 2010 was ~~36~~ ~~53~~39white-sided dolphins per year (0.~~55~~43~~94~~; Table 2).

Northeast Bottom Trawl

White-sided dolphin mortalities documented between 1991 and ~~2009~~ 2010 in the Northeast bottom trawl fishery were 1 during 1992, 0 in 1993, 2 in 1994, 0 in 1995-2001, 1 in 2002, 12 in 2003, 16 in 2004, 47 in 2005, 4 in 2006, 1 in 2007, 3 in 2008, ~~and~~ 31 in 2009, and 5~~10~~ in 2010. Estimated annual fishery-related mortalities (CV in parentheses) were 110 (0.97) in 1992, 0 in 1993, 182 (0.71) in 1994, 0 in 1995-1999, 137 (0.34) in 2000, 161 (0.34) in 2001, 70 (0.32) in 2002, 216 (0.27) in 2003, 200 (0.30) in 2004, 213 (0.28) in 2005, 164 (0.34) in 2006, 147 (0.35) in 2007, 147 (0.32) in 2008, ~~and~~ 131(0.26) in 2009, and 119 (0.39) in 2010. The ~~2005~~2006-~~2009~~ 2010 average mortality attributed to the Northeast bottom trawl was 142~~60~~ animals (0.15~~4~~; Table 2).

~~**Northeast Mid-water Trawl Fishery (Including Pair Trawl)**~~

~~In September 2005 three white-sided dolphins were observed taken in paired trawls targeting herring that were located near Jefferys Bank (off Maine). Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed white-sided dolphin takes per observed hours the gear was in the water) for each year, where the paired and single Northeast mid-water trawls were pooled and only hauls that targeted herring and mackerel were used. The VTR herring and mackerel data were used to estimate the total effort in the bycatch estimate (Palka, pers. comm.). Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001-2002, 22 (0.97) in 2003, 0 in 2004, 9.4 (1.03) in 2005, and 0 in 2006 to 2009 (Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during 2005-2009 was 1.9 (1.03; Table 2).~~

~~Mid-Atlantic~~mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

In March 2005, five white-sided dolphins were observed taken in paired trawls targeting mackerel that were off Virginia. In February 2006, three animals were observed taken in mackerel paired mid-water trawls north of Hudson Canyon. In March 2007, an animal was observed taken in a mackerel single mid-water trawl near Hudson Canyon. In January and February 2008 three animals were observed in herring single mid-water trawls north of Hudson Canyon. In March 2009 an animal was observed in a pair trawl targeting mackerel south of Hudson Canyon. No white-sided dolphin interactions with this fishery were observed in 2010. Due to small sample sizes, the ratio method was used to estimate the bycatch rate (observed white-sided dolphin takes per observed hours the gear was in the water) for each year, where the paired and single ~~Mid-Atlantic~~mid-Atlantic mid-water trawls were pooled and only hauls that targeted herring and mackerel were used. The VTR herring and mackerel data were used to estimate the total effort in the bycatch estimate (Palka, pers. comm.). Estimated annual fishery-related mortalities (CV in parentheses) were unknown in 2001-2002, 0 in 2003, 22 (0.99) in 2004, 58 (1.02) in 2005, 29 (0.74) in 2006, 12 (0.98) in 2007, 15 (0.73) in 2008, ~~and~~ 4 (0.92) in 2009, and 0 in 2010. (Table 2; Palka pers. comm.). The average annual estimated fishery-related mortality during ~~2005~~2006-~~2009~~ 2010 was ~~24~~ 12 (0.~~55~~45; Table 2).

~~Mid-Atlantic~~mid-Atlantic Bottom Trawl Fishery

One white-sided dolphin incidental take was observed in 1997, resulting in a mortality estimate of 161 (CV=1.58) animals. No takes were observed from 1998 through 2004 or in 2006 or 2008-~~2009~~2010; one take was observed in 2005 and 2 in 2007. Estimated annual fishery-related mortalities (CV in parentheses) were 27 (0.17) in 2000, 27 (0.19) in 2001, 25 (0.17) in 2002, 31 (0.25) in 2003, 26 (0.20) in 2004, 38 (0.29) in 2005, 26 (0.25) in 2006, 21 (0.24) in 2007, 16 (0.18) in 2008, ~~and~~ 16 (0.16) in 2009, and 22 (0.14) in 2010. The ~~2005~~2006-~~2009~~ 2010 average mortality attributed to the mid-Atlantic bottom trawl was ~~23~~ 20 animals (0.09; Table 2).

Table 2. Summary of the incidental mortality of white-sided dolphins (*Lagenorhynchus acutus*) by commercial fishery including the years sampled (Years), 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	Data Type [a]	Observer Coverage [b]	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet[d]	~~05~~06-~~09~~10	Obs. Data Weighout Trip Logbook	~~.07,~~ .04, .07, .05, .04, .17	~~5,~~ 2, 0, 4, 0, ~~xx~~6	~~59,~~ 41, 0, 81, 0, ~~143~~75	~~.49,~~ .71, 0, .57, 0, .87	~~36~~ 5339 (0.~~34~~43)
Northeast Bottom Trawl[c]	~~05~~06-~~09~~10	Obs. Data Weighout	~~.12,~~ .06, .06, .08, .09, .16	~~47,~~ 4, 1, 3, 31, 5~~10~~	~~213,~~ 164, 147, 147, 131, 119	~~.28, .~~.34, .35, .32, .26, .39	1~~42~~60 (0.1~~5~~4)
~~Northeast Mid-water Trawl - Including Pair Trawl~~	~~05-09~~	~~Obs. Data Weighout Trip Logbook~~	~~.199, .031, .08, .199, .42~~	~~3, 0, 0, 0, 0~~	~~0, 9.4, 0, 0, 0~~	~~0, 1.03, 0, 0, 0~~	~~1.9 (1.03)~~
~~Mid-Atlantic~~mid-Atlantic Mid-water Trawl - Including Pair Trawl	~~05~~06-~~09~~10	Obs. Data Weighout Trip Logbook	~~.084,~~ .089, .039, .133, .132, .25	~~5,~~ 3, 1, 3, 1, 0	~~58,~~ 29, 12, 15, 4, 0	~~1.02,~~ .74, .98, .73, .92, 0	~~24~~12 (0.~~55~~45)
~~Mid-Atlantic~~mid-Atlantic Bottom Trawl[c]	~~05~~06-~~09~~10	Obs. Data Weighout Trip Logbook	~~.03,~~ .02, .03, .03, .05, .06	~~1,~~ 0, 2, 0, 0, 0	~~38,~~ 26, 21, 16, 16, 22	~~.29, .~~.25, .24, .18, .16, .14	20~~3~~ (.09~~12~~)
Total							~~227~~213 ~~45~~ (0.1~~6~~32)

a Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Observer Program. NEFSC collects landings data (Weighout) that are used as a measure of total effort in the Northeast gillnet fishery. Mandatory Vessel Trip Report (VTR) (Trip Logbook) data are used to determine the spatial distribution of fishing effort in the sink gillnet fishery and in the two mid-water trawl fisheries. In addition, the Trip Logbooks are the primary source of the measure of total effort (soak duration) in the

	mid-water and bottom trawl fisheries.
b	Observer coverages for the Northeast sink gillnet are ratios based on metric tons of fish landed. Observer coverages of the trawl fisheries are ratios based on trips. Total observer coverage reported for bottom trawl gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP). In the Northeast region 437 and 658 trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 trips were sampled by observers and monitors, respectively.
c	NE and MA bottom trawl mortality estimates reported for 2008-2010 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005; Rossman 2010) and 2008 effort collected from the respective year, 2008-2010 (Rossman 2010). NE and MA bottom trawl mortality estimates reported for 2009 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2009 effort (Rossman 2010).
d	After 1998, a weighted bycatch rate was applied to effort from both pingered and non-pingered hauls within the stratum where white-sided dolphins were observed taken. During the years 1997, 1999, 2001, 2002, and 2004, respectively, there were 2, 1, 1, 1, and 1 observed white-sided dolphins taken on pingered trips. No takes were observed on pinger trips during 1995, 1996, 1998, 2000, 2005 through 2007. Three of the 2008 takes were on non-pingered hauls and the fourth take was recorded as pinger condition unknown. Of the six 2010 observed takes, 4 were in pingered nets and 2 in non-pingered nets.

CANADA

There is little information available that quantifies fishery interactions involving white-sided dolphins in Canadian waters. Two white-sided dolphins were reported caught in groundfish gillnet sets in the Bay of Fundy during 1985 to 1989, and 9 were reported taken in West Greenland between 1964 and 1966 in the now non-operational salmon drift nets (Gaskin 1992). Several (number not specified) were also taken during the 1960s in the now non-operational Newfoundland and Labrador groundfish gillnets. A few (number not specified) were taken in an experimental drift gillnet fishery for salmon off West Greenland which took place from 1965 to 1982 (Read 1994).

Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in Canadian waters, on 25-40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. Bycaught marine mammals were noted as weight in kilos rather than by the numbers of animals caught. Thus the number of individuals was estimated by dividing the total weight per species per trip by the maximum recorded weight of each species. During 1991 through 1996, an estimated 6 white-sided dolphins were observed taken. One animal was from a longline trip south of the Grand Banks (43º 10'N 53º 08'W) in November 1996 and the other 5 were taken in the bottom trawl fishery off Nova Scotia in the Atlantic Ocean; 1 in July 1991, 1 in April 1992, 1 in May 1992, 1 in April 1993, 1 in June 1993 and 0 in 1994 to 1996.

Estimation of small cetacean bycatch for Newfoundland fisheries using data collected during 2001 to 2003 (Benjamins *et al.* 2007) indicated that, while most of the estimated 862 to 2,228 animals caught were harbor porpoises, a few were white-sided dolphins caught in the Newfoundland nearshore gillnet fishery and offshore monkfish/skate gillnet fisheries.

Herring Weirs

During the last several years, one white-sided dolphin was released alive and unharmed from a herring weir in the Bay of Fundy (A. Westgate, pers. comm.). Due to the formation of a cooperative program between Canadian fishermen and biologists, it is expected that most dolphins and whales will be able to be released alive. Fishery information is available in Appendix III.

Other Mortality

U.S.

During 20052006-2009 2010 there were 245 218 documented Atlantic white-sided dolphin strandings on the US Atlantic coast (Table 3). Forty of these animals were released alive. Human interaction was indicated in 14 11 records during this period. Of these, one wastwo were classified as a fishery interactions.

Mass strandings involving up to a hundred or more animals at one time are common for this species. The causes of these strandings are not known. Because such strandings have been known since antiquity, it could be presumed that recent strandings are a normal condition (Gaskin 1992). It is unknown whether human causes, such as fishery interactions and pollution, have increased the number of strandings. In Bogomolni's analysis of mortality causes of stranded marine mammals on Cape Cod and southeastern Massachusetts between 2000 and 2006, 69% of stranded white-sided dolphins were involved in mass-stranding events, and 21% of all the white-sided dolphin stranding mortalities were disease related (Bogomolni 2010). An Unusual Mortality Event (UME) was declared in 2008 due to a relatively high number of strandings between January and April 2008, from New Jersey to North Carolina. Five white-sided dolphins were involved in this event (http://www.nmfs.noaa.gov/pr/health/mmume/midatlantic2008.htm, accessed 19 April 2011).

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.

CANADA

Small numbers of white-sided dolphins have been hunted off southwestern Greenland and they have been taken deliberately by shooting elsewhere in Canada (Reeves *et al.* 1999). The Nova Scotia Stranding Network documented whales and dolphins stranded on the coast of Nova Scotia during 1991 to 1996 (Hooker *et al.* 1997). Researchers with Dept. of Fisheries and Oceans (DFO), Canada documented strandings on the beaches of Sable Island during 1970 to 1998 (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. White-sided dolphins stranded at nearly all times of the year on the mainland and on Sable Island. On the mainland of Nova Scotia, a total of 34 stranded white-sided dolphins was recorded between 1991 and 1996: 2 in 1991 (August and October), 26 in July 1992, 1 in Nov 1993, 2 in 1994 (February and November), 2 in 1995 (April and August) and 2 in 1996 (October and December). During July 1992, 26 white-sided dolphins stranded on the Atlantic side of Cape Breton. Of these, 11 were released alive and the rest were found dead. Among the rest of the Nova Scotia strandings, one was found in Minas Basin, two near Yarmouth and the rest near Halifax. On Sable Island, 10 stranded white-sided dolphins were documented between 1991 and 1998; all were males, 7 were young males (< 200 cm), 1 in January 1993, 5 in March 1993, 1 in August 1995, 1 in December 1996, 1 in April 1997 and 1 in February 1998.

Whales and dolphins stranded between 1997 and 2009 on the coast of Nova Scotia as recorded by the Marine Animal Response Society (MARS) and the Nova Scotia Stranding Network are as follows (Table 3): 0 white-sided dolphins stranded in 1997 to 2000, 3 in September 2001 (released alive), 5 in November 2002 (4 were released alive), 0 in 2003, 19-24 in 2004 (15-20 in October (some (unspecified) were released alive) and 4 in November were released alive), 0 in 2005, and 1 in 2006, 8-10 in 2007 (all but 3 released alive), 3 (one released alive) in 2008, ~~and~~ 4 (3 released alive) in 2009, and 2 in 2010 (T. Wimmer, pers. comm.).

White-sided dolphins recorded by the Whale Release and Strandings Program in Newfoundland and Labrador are as follows: 1 animal (released alive) in 2004, 1 in 2005 (dead), 3 in 2006 (all dead), 1 in 2007 (released alive) 2 in 2008 (one released alive and one dead), ~~and~~ 3 (all dead) in 2009, and 2 (one released alive and one dead) in 2010 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009~~:~~; 2010; 2011).

~~Table 3. White-sided dolphin (*Lagenorhynchus acutus*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2005-2009.~~

~~Area~~	-				-	~~**Total**~~
	~~2005~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	
~~Maine~~	~~3~~	~~3~~	~~1~~	~~1~~	~~1~~	~~9~~
~~New Hampshire~~	~~1~~	-	-	-	~~1~~	~~2~~
~~Massachusetts~~[a,b]	~~60~~	~~49~~	~~18~~	~~33~~	~~22~~	~~182~~
~~Rhode Island~~	~~2~~	~~4~~	-	-	~~1~~	~~7~~
~~Connecticut~~	-	-	-	~~1~~	~~1~~	~~2~~
~~New York~~[c]	-	~~3~~	~~5~~	~~1~~	~~3~~	~~12~~

New Jersey	6	1	-	-	2	9
Delaware	-	1	-	-	1	2
Maryland	1	1	-	1	-	3
Virginia[b]	3	3	-	1	-	7
North Carolina	3	1	1	3	1	9
South Carolina	-	-	-	1	-	1
TOTAL US	**79**	**66**	**25**	**42**	**33**	245
Nova Scotia	-	1	9	3	4	17
Newfoundland and Labrador	1	3	1	2	3	10
GRAND TOTAL	80	70	35	47	40	272

[a] Records of mass strandings in Massachusetts during this period are: February 2005 - 8 animals (3 released alive); April 2005 - 6 animals (all released alive); May 2005 strandings of 2 animals (both released alive but one died later); 3 animals (one released alive) and 5 animals; December 2005 - 2 animals; January 2006 - 4 separate events involving 23 white-sided dolphins (5 released alive); February 2006 - 2 events involving 1 and 5 animals; July 2006 - 9 animals (7 released alive); January 2007 - 9 animals (3 released alive); September 2007 - 3 animals; January 2008 -17animals, February 2008 - 3 animals (2 released alive); September 2009 - 3 events of 2, 3 and 4 animals (all but 1 released alive); April 2009 - 3 animals (all released alive).

[b] In 2005, 5 animals had signs of human interaction but in no case was the human interaction able to be determined to be the cause of death. In 2006, 1 animal from Massachusetts was classified as having signs of fishery interaction. In 2008, 2 animals from Massachusetts and one from South Carolina were classified as human interactions. In 2009, the 4 animals that mass-stranded in September and were released alive, as well as a March stranding that a bystanded had attempted to rescue were classified at human interactions.

[c] Records of mass strandings in New York during this period are: September 2007 - 3 animals.

Table 3. White-sided dolphin (*Lagenorhynchus acutus*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2006-2010.

Area	2006	2007	2008	2009	2010	**Total**
Maine	3	1	1	1	1	7
New Hampshire	0	0	0	1	0	1
Massachusetts[a,b]	49	18	33	22	50	172
Rhode Island	4	0	0	1	0	5

Connecticut	0	0	1	1	0	2
New York[c]	3	5	1	3	1	13
New Jersey	1	0	0	2	0	3
Delaware	1	0		1	0	2
Maryland	1	0	1	0	0	2
Virginia	3	0	1	0	0	4
North Carolina	1	1	3	1	0	6
South Carolina[b]	0	0	1	0	0	1
TOTAL US	**66**	**25**	**42**	**33**	**52**	**218**
Nova Scotia	1	9	3	4	2	19
Newfoundland and Labrador	3	1	2	3	2	11
GRAND TOTAL	**70**	**35**	**47**	**40**	**56**	**248**

[a] Records of mass strandings in Massachusetts during this period are: January 2006 - 4 separate events involving 23 white-sided dolphins (5 released alive); February 2006 - 2 events involving 1 and 5 animals; July 2006 - 9 animals (7 released alive); January 2007 - 9 animals (3 released alive); September 2007 - 3 animals; January 2008 -17animals, February 2008 - 3 animals (2 released alive); September 2009 - 3 events of 2, 3 and 4 animals (all but 1 released alive); April 2009 - 3 animals (all released alive); March 2010 - 7 animals (one dead calf, 6 adults released alive), 16 animals (5 dead, 11 released alive) and 3 animals (one released alive); April 2010 - 2 animals (released alive); July 2010 - 2 animals (released alive).

[b] In 2006, 1 animal from Massachusetts was classified as having signs of fishery interaction. In 2008, 2 animals from Massachusetts and one from South Carolina were classified as human interactions. In 2009, the 4 animals that mass-stranded in September and were released alive, as well as a March stranding that a bystander had attempted to rescue were classified at human interactions. In 2010, 2 animals in Massachusetts were classified as human interactions, one of them a fishery interaction.

STATUS OF STOCK

This is not a strategic stock because the 2006-2010 estimated average annual human related mortality does not exceeds PBR. The total U.S. 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. The status of white-sided dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. A trend analysis has not been conducted for this species. The species is not listed as threatened or endangered under the Endangered Species Act. ~~A trend analysis has not been conducted for this species. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. This is~~ not a~~a strategic stock because the 2005-2009 estimated average annual human related mortality~~ does not ~~exceeds PBR.~~

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SHORT-BEAKED COMMON DOLPHIN (*Delphinus delphis delphis*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The common dolphin may be one of the most widely distributed species of cetaceans, as it is found world-wide in temperate and subtropical seas. In the North Atlantic, common dolphins occur over the continental shelf along the 100-2000-m isobaths and over prominent underwater topography and east as to the mid-Atlantic Ridge (29˚W) (Doksaeter *et al.* 2008; Waring *et al*. 2008). The species is less common south of Cape Hatteras, although schools have been reported as far south as the Georgia/South Carolina border (32º N) (Jefferson *et al*. 2009). In waters off the northeastern USA coast, common dolphins are distributed along the continental slope and are associated with Gulf Stream features (CETAP 1982; Selzer and Payne 1988; Waring *et al.* 1992; Hamazaki 2002). They occur from Cape Hatteras northeast to Georges Bank (35˚ to 42˚N) during mid-January to May (Hain *et al.* 1981; CETAP 1982; Payne *et al.* 1984). Common dolphins move onto Georges Bank and the Scotian Shelf from mid-summer to autumn. Selzer and Payne (1988) reported very large aggregations (greater than 3,000 animals) on Georges Bank in autumn. Common dolphins are occasionally found in the Gulf of Maine (Selzer and Payne 1988), but more often in the last few years (Figure 1). Migration onto the Scotian Shelf and continental shelf off Newfoundland occurs during summer and autumn when water temperatures exceed 11ºC (Sergeant *et al.* 1970; Gowans and Whitehead 1995).

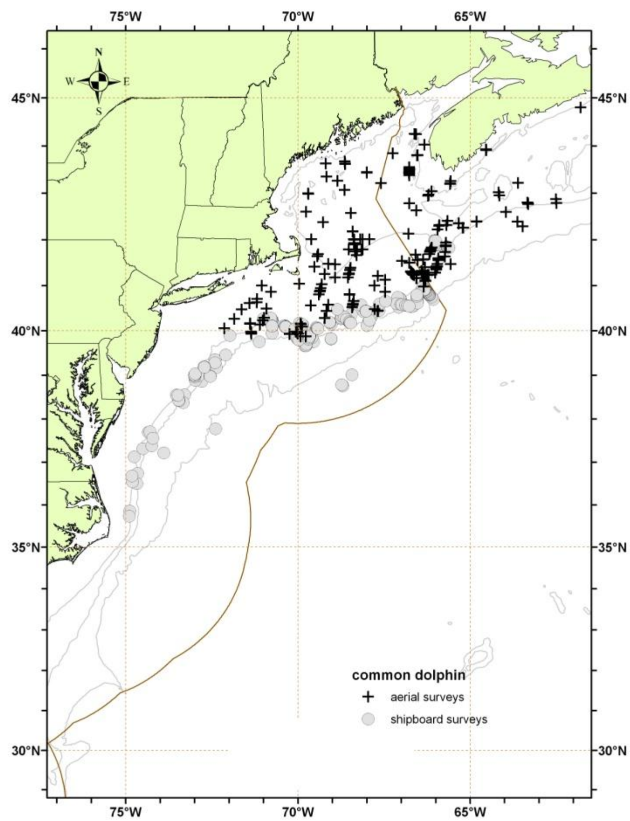

Figure 1. *Distribution of common dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1998, 1999, 2002, 2004, 2006 and 2007. Isobaths are the 100-m, 1000-m and 4000-m depth contours.*

Westgate (2005) tested the proposed one-population-stock model using a molecular analysis of mitochondrial DNA (mtDNA), as well as a morphometric analysis of cranial specimens. Both genetic analysis and skull morphometrics failed to provide evidence ($p>0.05$) of more than a single population in the western North Atlantic, supporting the proposed one--stock model. However, when western and eastern North Atlantic common dolphin mtDNA and skull morphology were compared, both the cranial and mtDNA results showed evidence of restricted gene flow ($p<0.05$) indicating that these two areas are not panmictic. Cranial specimens from the two sides of the North Atlantic differed primarily in elements associated with the rostrum. These results suggest that common dolphins in the western North Atlantic are composed of a single panmictic group whereas gene flow between the western and eastern North Atlantic is limited (Westgate 2005; 2007).

There is also a peak in parturition during July and August with an average birth day of 28 July. Gestation lasts about 11.7 months and lactation lasts at least a year. Given these results western North Atlantic female common dolphins are likely on a 2-3 year calving interval. Females become sexually mature earlier (8.3 years and 200 cm) than males (9.5 years and 215 cm) as males continue to increase in size and mass. There is significant sexual dimorphism present with males being on average about 9% larger in body length (Westgate 2005; Westgate and Read 2007).

POPULATION SIZE

~~The total number of common dolphins off the U.S. or Canadian Atlantic coast is unknown, although s~~Several abundance estimates are available for common dolphins from selected regions for selected time periods. The current best abundance estimate for common dolphins off the U.S. or Canadian Atlantic coast is the result of the 2011 survey—67,191 (CV=0.29).~~120,743 animals (CV=0.23). This is the sum of the estimates from two 2004 U.S. Atlantic surveys, where the estimate from the northern U.S. Atlantic is 90,547 (CV=0.24), and from the southern U.S. Atlantic is 30,196 (CV=0.54). This joint estimate is considered best because these two surveys have the most complete coverage of the species' habitat (Table 1).~~

An abundance estimate of 90,547 (CV=0.244) common dolphins was obtained 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 trackline in waters north of Maryland (38ºN) (Table 1; Palka 2006). Shipboard data were collected using the two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995) accounting for biases due to school size and other potential covariates, reactive movements (Palka and Hammond 2001), and *g(0)*, the probability of detecting a group on the trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).

An abundance estimate of 30,196 (CV=0.537) common dolphins was derived from 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 38º N latitude) conducted during June-August, 2004 (Table 1). The survey employed two independent visual teams searching with 25x bigeye binoculars. Survey effort was stratified to include increased effort along the continental shelf break and Gulf Stream front in the ~~Mid-Atlantic~~mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters north of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias (*g(0)*) and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001; Palka 2006).

An abundance estimate of 84,000 (CV=0.36) common dolphins was obtained from an aerial survey conducted in August 2006 which covered 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence (Table 1; Palka pers. comm.).

An~~n~~ abundance estimate of 173,486 (CV=0.55)~~53,625 (95% CI=35,179-81,773)~~ common dolphins was generated from the Canadian Trans North Atlantic Sighting Survey ~~(TNASS)~~ in July-August 2007 (Lawson and Gosselin 2009). ~~–~~This aerial survey covered area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general this involved correcting for perception bias using mark-recapture distance sampling (M~~C~~RDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (2007) analysis method (Lawson and Gosselin in 2011). ~~The estimate was corrected for availability and perception bias.Estimates from this survey have not yet been corrected for availability and perception biases (Lawson and Gosselin 2009).~~

An abundance estimate of 67,191 (CV=0.29) common dolphins was generated from a shipboard and aerial survey conducted during June~~–~~August 2011. The aerial portion~~ed~~ covered 6,850 km of tracklines that were over waters ~~from Massachusetts to New Brunswick, Canada (waters~~ north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy~~)~~. The shipboard portion~~ed~~ covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the ~~mark-recapture distance sampling (~~MRDS~~)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Please see appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.~~As recommended in the GAMMS~~

Workshop Report (Wade and Angliss 1997), if estimates are older than eight years PBR is undetermined.

Table 1. Summary of abundance estimates for western North Atlantic short-beaked common dolphin. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to Bay of Fundy	90,547	0.24
Jun-Aug 2004	Florida to Maryland	30,196	0.54
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	120,743	0.23
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	84,000	0.36
July-Aug 2007	N. Labrador to Scotian Shelf	53,625173,486	0.2229
Jul-Aug 2011	North Carolina to lower Bay of Fundy	67,19170,756	0.29

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 common dolphins is 120,74370,75667,191 animals (CV=0.293) derived from the 2004 2011 surveys. The minimum population estimate for the western North Atlantic common dolphin is 99,97555,81852,893.

Current Population Trend

A trend analysis has not been conducted 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"recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 99,97555,81852,893 animals. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery"recovery factor is 0.5, the default value for stocks of unknown status relative to optimum sustainable population (OSP), and because the CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the western North Atlantic stock of common dolphin is 5582911,000.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality or serious injury to this stock during 20052006-2009 2010 was 165 166 (CV=0.1211) common dolphins.

Fishery information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

For more details on the historical fishery interactions prior to 1999 see Waring *et al.* (2007).

In the Atlantic pelagic longline fishery between 1990 and 2007, 20 common dolphins were observed hooked and released alive.

The estimated fishery-related mortality of common dolphins attributable to the *Loligo* squid portion of the Southern New England/~~Mid-Atlantic~~mid-Atlantic Squid, Mackerel, Butterfish Trawl fisheries was 0 between 1997-1998 and 49 in 1999 (CV=0.97). After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl fishery.

In the Atlantic mackerel portion of the Southern New England/~~Mid-Atlantic~~mid-Atlantic Squid, Mackerel, Butterfish Trawl fisheries, the estimated fishery-related mortality was 161 (CV=0.49) animals in 1997 and 0 in 1998 and 1999. However, the estimates in both the mackerel and *Loligo* fisheries should be viewed with caution due to the extremely low (<1%) observer coverage. After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl and mid-Atlantic mid-water trawl fisheries.

There was one observed take in the Southern New England/mid-Atlantic Bottom Trawl fishery reported in 1997. The estimated fishery-related mortality for common dolphins attributable to this fishery was 93 (CV=1.06) in 1997 and 0 in 1998 and 1999. After 1999 this fishery is included as a component of the mid-Atlantic bottom trawl fishery.

Northeast Sink Gillnet

In 1990, an observer program was started by NMFS to investigate marine mammal takes in the Northeast sink gillnet fishery (Appendix III). Bycatch in the northern Gulf of Maine occurs primarily from June to September, while in the southern Gulf of Maine, bycatch occurs from January to May and September to December. Four common dolphins were observed taken in northeast sink gillnet fisheries in 2005, one in 2006, one in 2007, two in 2008 ~~and~~, 3 in 2009, and 4 in 2010. The estimated annual fishery-related mortality and serious injury attributable to the northeast sink gillnet fishery (CV in parentheses) was 0 in 1995, 63 in 1996 (1.39), 0 in 1997, 0 in 1998, 146 in 1999 (0.97), 0 in 2000-2004, 5 (0.80) in 2005, 20 (1.05) in 2006, 11 (0.94) in 2007, 34 (0.77) in 2008, ~~and~~ 43 (0.77) in 2009, and ~~77~~54 (0.~~89~~71) in 2010. The ~~2005~~2006-~~2009~~ 2010 average annual mortality attributed to the northeast sink gillnet was ~~27~~ 3~~7~~2 animals (CV=0.~~3945~~38).

A study of the effects of two different hanging ratios in the bottom-~~-~~set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´) in February, March and April. Eight research strings of fourteen nets each were fished, and 159 hauls were completed during the course of the study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. One common dolphin was caught in this study south of New England during 2009, another common dolphin was caught in this experimental fishery off New Jersey in Spring~~,~~ 2010 ~~-~~(Schnaittacher 2011). These 2 takes are included in Table 2.

~~A study of the effects of tie-downs and bycatch rates of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in both control and experimental gillnet gear operating in Statistical Area 612 (off NY and NJ) between 14 Nov. 2010 to 18 Dec. 2010 had 100% observer coverage. This experimental fishery captured 7 Common dolphins and two unidentified dolphins, (unidentified due to lack of photos) during this time period (Milliken 2011).~~

~~Mid-Atlantic~~mid-Atlantic Gillnet

~~One common dolphin was taken in an observed trip during 2006.~~ Two common dolphins were observed taken in 1995, 1996, ~~-~~and ~~and~~ 1997~~,, and 2010 and~~ and no takes were observed from 1998 to 2005~~,~~. One common dolphin was taken in an observed trip during 2006, ~~.~~ none were observed in 2007 ~~-~~– 2009, and 10 takes were observed in 2010. Using the observed takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 7.4 in 1995 (0.69), 43 in 1996 (0.79), 16 in 1997 (0.53), ~~and~~ 0 in 1998-2005, 11 (1.03) in 2006, 0 in 2007 ~~-~~– 2009, and 31 (0.65) in 2010. Average annual estimated fishery-related mortality attributable to this fishery during ~~2005~~2006-~~2009~~ 2010 was ~~2~~ 8.4 (CV=0~~1.03~~.55) common dolphins (Table 2). A study of the effects of tie-downs and bycatch rates of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*) in both control and experimental gillnet gear operating in Statistical Area 612 (off NY and NJ) between 14 Nov. 2010 to 18 Dec. 2010 had 100% observer coverage. This experimental fishery captured 7 common dolphins and two unidentified dolphins, (unidentified due to lack of photos) during this time period (~~Milliken~~Fox *et al.* 2011). These 7 takes are included in Table 2.

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. One common dolphin was observed taken in 2002, 3 in 2004, 5 in 2005, 1 in 2006, 3 in 2007, 1 in 2008, and 5 in 2009 and 9 in 2010 (Table 2). The estimated annual fishery-related mortality and serious injury attributable to the northeast bottom trawl fishery (CV in parentheses) was 27 in 2000 (0.29), 30 (0.30) in 2001, 26 (0.29) in 2002, 26 (0.29) in 2003, 26 (0.29) in 2004, 32 (0.28) in 2005, 25 in 2006, 24 (0.28) in 2007, 17 (0.29) in 2008, and 19 (0.30) in 2009, and 17 (0.28) in 2010. The 20052006-2009 2010 average annual mortality attributed to the northeast bottom trawl was 23 20 animals (CV=0.13).

Mid-Atlanticmid-Atlantic Bottom Trawl

Three common dolphins were observed taken in mid-Atlantic bottom trawl fisheries in 2000, 2 in 2001, 9 in 2004, 15 in 2005, 14 in 2006, 0 in 2007, 1 in 2008, and 12 in 2009, and 2 in 2010 (Table 2). The estimated annual fishery-related mortality and serious injury attributable to the northeast bottom trawl fishery (CV in parentheses) was 93 in 2000 (0.26), 103 (0.27) in 2001, 87 (0.27) in 2002, 99 (0.28) in 2003, 159 (0.30) in 2004, 141 (0.29) in 2005, 131 (0.28) in 2006, 66 (0.27) in 2007, 108 (0.28) in 2008, and 104 (0.29) in 2009 and 104 (0.29) in 2010. The 20052006-2009 2010 average annual mortality attributed to the mid-Atlantic bottom trawl was 110 103 animals (CV=0.13).

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

A short-beaked common dolphin mortality was observed in this fishery in 2010 (Table 2) but an expantended bycatch estimaterate has not been calculated since the observed takes are so rare.

Mid-Atlanticmid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

The first year a short-beaked common dolphin mortality had been observed in this fishery was in 2007. was the first year a short-beaked common dolphin mortality had been observed in this fishery. This animal was taken in the same haul as an Atlantic white-sided dolphin. Due to small sample sizes, the bycatch rate model used the 2003 to September 2007 observed mid-water trawl data, including paired and single, and northeast and mid-Atlantic mid-water trawls (Palka, pers. com.). The model that best fit these data was a Poisson logistic regression model that included latitude and bottom depth as significant explanatory variables, where soak duration was the unit of effort. The resultant estimated annual fishery-related mortality and serious injury (CV in parentheses) was 3.2 (0.70) for 2007. The 20052006-2009 2010 average annual mortality attributed to the mid-Atlantic mid-water trawl was 1 0.6 (0.70) animals.

Pelagic Longline

In 2009, a common dolphin mortality was observed in the pelagic longline fishery, mid-Atlantic Bight fishing area (Garrison and Stokes 2010). The expandtrapolated estimate (CV in parentheses) for common dolphin bycatch attributed to this fishery was 8.5 (1.0) for 2009. -The 20052006-2009 2010 average annual mortality was 1.7 (1.0).

Table 2. Summary of the incidental mortality of short-beaked common dolphins (*Delphinus delphis delphis*) by commercial fishery including the years sampled (Years), 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 [a]	Years	Data Type [b]	Observer Coverage [c]	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Estimated CVs	Mean Annual Mortality

Northeast Sink Gillnet[e]	~~05~~06 - ~~09~~10	Obs. Data, Trip Logbook, Allocated Dealer Data	~~.07,~~ .04, .07, .05, .04, .17	0, 0, 0, 0, 0	~~4,~~ 1, 1, 2, 3, 54	0, 0, 0, 0, 0	~~26,~~ 20, 11, 34, 43, 54	~~26,~~ 20, 11, 34, 43, 54	~~.8,~~ 1.05, .94, .77, .77, .8971	~~27~~ 32 (~~0.39~~.45.38)
~~Mid-Atlantic~~mid-Atlantic Gillnet[e]	06-10~~05~~ ~~-09~~	Obs. Data, Trip Logbook, Allocated Dealer Data	~~.02,~~ .03, .04, .03, .03, .04	0, 0, 0, 0, 0	~~0,~~ 1, 0, 0, 0, 10	0, 0, 0, 0, 0	~~0,~~ 11, 0, 0, 0, 31	~~0, 0,~~ 11, 0, 0, 0, 31	~~0,~~ 1.03, 0, 0, 0, ~~0~~.65	~~2.2~~8.4 (~~1.03~~.55)
~~Mid-Atlantic~~mid-Atlantic Mid-water Trawl - Including Pair Trawl	06-10~~05~~ ~~-09~~	Obs. Data Weighout Trip Logbook	~~.084,~~ .089, .039, .13, .13, .25	0, 0, 0, 0, 0	~~0,~~ 0, 1, 0, 0, 0	0, 0, 0, 0, 0,	~~0,~~ 0, 3.2, 0, 0, 0	~~0,~~ 0, 3.2, 0, 0, 0	~~0, 0,~~ 0, .70, 0, 0, 0, 0	0.6 (.70)
Northeast Mid-water Trawl - Including Pair Trawl	06-10	Obs. Data Weighout Trip Logbook	.031, .08, .199, .42, .54	0, 0, 0, 0, 0	0, 0, 0, 0, 1	0, 0, 0, 0, 0	0, 0, 0, 0, na	0, 0, 0 , 0, na	0, 0, 0 , 0, na	na
Northeast Bottom Trawl[d]	06-10~~05~~ ~~-09~~	Obs. Data Dealer Data VTR Data	~~.12,~~ .06, .06, .08, .09, .16	0, 0, 0, 0, 0	~~5,~~ 1, 3, 1, 5, 9	0, 0, 0, 0, 0	~~32,~~ 25, 24, 17, 19, 17	~~32,~~ 25, 24, 17, 19, 17	~~.28,~~ .28, .28, .29, .30, .28	~~23~~ 20 (.13)
~~Mid-Atlantic~~mid-Atlantic Bottom Trawl[d]	06-10~~05~~ ~~-09~~	Obs. Data Dealer	~~.03,~~ .02, .03, .03. .05, .06	0, 0, 0, 0 , 0	~~15,~~ 14, 0, 1, 12, 2	0, 0, 0, 0, 0	~~141,~~ 131, 66, 108, 104, 104	~~141,~~ 131, 66, 108, 104, 104	~~.29,~~ .28, .27, .28, .29, .29	~~110~~ 103 (.13)
Pelagic Longline[b]	06-10~~05~~ ~~-09~~	Obs. Data Logbook	~~.06,~~ .07, .07, .07, .10, .08	0, 0, 0, 0, 0	~~0,~~ 0, 0, 0, 1, 0	0, 0, 0, 0, 0	~~0,~~ 0, 0, 0, 8.5, 0	~~0,~~ 0, 0, 0, 8.5, 0	~~0,~~ 0, 0, 0, 1.0, 0	1.7 (1.0)
TOTAL										~~165~~ 166 (.11) ~~(.12)~~

a. The fisheries listed in Table 2 reflect new definitions defined by the proposed List of Fisheries for 2005 (FR Vol. 69, No. 231, 2004). The 'North Atlantic bottom trawl' fishery is now referred to as the 'Northeast bottom trawl.' The Illex, Loligo and Mackerel fisheries are now part of the 'mid-Atlantic bottom trawl' and 'mid-Atlantic midwater trawl' fisheries.

b. Observer data (Obs. Data), used to measure bycatch rates, are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (Dealer reported data) which are used as a measure of total landings and mandatory Vessel Trip Reports (VTR) (Trip Logbook) that are used to determine the spatial distribution of landings and fishing effort.

c. The observer coverages for the Northeast sink gillnet fishery are ratios based on tons of fish landed. North Atlantic bottom trawl mid-Atlantic bottom trawl, and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes only samples collected from traditional fisheries observer~~s~~, but not the fishery monitors. In the Northeast region 437 and 658 bottom trawl trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 bottom trawl trips were sampled by observers and monitors, respectively~~,~~. Monitor trips will be incorporated next year, for 2011, the first full year of monitor coverage.

d. NE and MA bottom trawl mortality estimates reported for 2007-2010 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005; Rossman 2010) and the respective annual fishing~~2007~~ effort (2007-2010). ~~NE and MA bottom trawl mortality estimates reported for 2008 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2008 effort. NE and MA bottom trawl mortality estimates reported for 2009 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2009 effort (Rossman 2010).~~ Because of this pooling, years with no observed mortality may still have a calculated estimate. ~~NE and MA bottom trawl mortality estimates reported for 2010 are a product of GLM estimated bycatch rates (utilizing observer data collected from 2000 to 2005) and 2010 effort.~~ The methods used in Rossman 2010 are scheduled to be updated during 2012-2013 to reflect data collected during the latest five year (2006-2010) period. 2010 estimates include only takes observed by traditional fishery observers. Observed t~~T~~akes do not include those observed by fishery 'monitors' ~~are not included~~ and so are not incorporated into 2010 bycatch estimation.

e. One common dolphin was incidentally caught in 2009 and one in 2010 as part of a ~~2009~~ NEFSC hanging ratio study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. Seven common dolphins were caught in another research study in 2010. ~~This~~ These animals ~~was~~ are included in the observed interactions and added to the total estimates, though ~~this~~these interactions and ~~its~~ their associated fishing effort were not included in bycatch rate calculations.

CANADA

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 Banks) (Lens 1997). A total of 47 incidental catches were recorded, which included one common dolphin. The incidental mortality rate for common dolphins was 0.007/set.

Other Mortality

Two common dolphins were reported as incidental mortalities in NEFSC Atlantic herring monitoring activities in 2004. In 2007, one common dolphin was reported taken in a NEFSC spring bottom trawl survey.

From ~~2005~~ 2006 to ~~2009~~2010, ~~428~~ 469 common dolphins were reported stranded between Maine and Florida (Table 3). The total includes mass stranded common dolphins in Massachusetts during ~~2005 (a total of 43 in 4 separate events),~~ 2006 (a total of 65 in 10 events), 2007 (a total of 23 in 5 separate events), 2008 (one event of 5 animals and one of 2 animals) ~~and~~, 2009 (a total of 26 in 6 events) and 2010 (a total of 30 in 8 events). ~~Five of the 2005 Massachusetts stranded animals, 18~~Eighteen animals in 2006, 2 animals in 2007, 2 animals in 2008 ~~and~~, 5 animals in 2009 and 11 animals in 2010 were released or last sighted alive. Human interactions were indicated on ~~one of the 2005 and~~ one of the 2007 New York mortality records and one of the 2006 Virginia mortality records. In 2008, seven common dolphins had indications of human interactions, four which were fishery interactions. In 2009, six common dolphins had indications of human interaction, 3 of which were classified as fishery interactions. In 2010, 7 animals were classified as human interactions, 3 of which were fishery interactions (all Massachusetts mass-stranded animals) and 2 of which (Rhode Island) involved animals last sighted free-swimming. An Unusual Mortality Event (UME) was declared in 2008 due to a relatively high number of strandings between January and April 2008, from New Jersey to North Carolina. Twenty seven common dolphins were involved in this event (http://www.nmfs.noaa.gov/pr/health/mmume/midatlantic2008.htm accessed 19 April 2011). In Bogomolni's 2010 analysis of mortality causes of stranded marine mammals on Cape Cod and southeastern Massachusetts between 2000 and 2006, 61% of stranded common dolphins were involved in mass-stranding events, and 37% of all the common dolphin stranding mortalities were disease related (Bogomolni 2010).

Four common dolphin strandings (6 individuals) were reported on Sable Island, Nova Scotia from 1996 to 1998 (Lucas and Hooker 1997; 2000). The Marine Animal Response Society of Nova Scotia reported one common dolphin stranded in 2008, ~~and~~ one in 2009 and one (released alive) in 2010 (Tonya Wimmer, pers. comm.).

~~Table 3. Short-beaked common dolphin (*Delphinus delphis delphis*) reported strandings along the U.S. Atlantic coast, 2005-2009.~~

STATE	2005	2006	2007	2008	2009	TOTALS
Maine	0	0	1	0	0	1
Massachusetts[a]	64	100	65	19	53	301
Rhode Island[c]	0	2	4	3	6	15
New York [b, c]	4	3	23	2	7	39
New Jersey	4	2	4	9	7	26
Delaware[c]	1	0	0	2	4	7
Maryland	0	0	0	2	2	4
Virginia[c]	2	1	4	22	2	31
North Carolina[c]	1	2	0	1	0	4
EZ	0	0	0	0	0	0
TOTALS	76	110	101	60	81	428

a. Massachusetts mass strandings (2005 - 7,5,25, and 4; 2006 - 2,2,3,4,4,3,9,10,14, and 14; 2007 - 9,2,4,6,2; 2008 - 5 and 2; 2009 - 2,3, 4,6,8).

b. One common dolphin was released alive from a pound net in 2006 in New York. Twenty (12 dead, 8 rescued; one of the mortalities classified as human interaction) animals involved in a mass stranding in Suffolk county in 2007. Seven animals involved in 2 mass stranding events in March 2009 (six euthanized, 1 died at site, 2 had signs of fishery interaction). In addition, in 2008 3 animals were relocated from the Nansemond River.

c. One 2005 mortality in New York reported as having human interaction and one in VA in 2006. Seven records with signs of human interaction in 2008 - 3 from Virginia, 1 from Massachuisetts, one from North Carolina, and one from Delaware. Of these, 4 were fishery interactions. Six human interaction cases in 2009 (2 Massachusetts, 3 Rhode Island, 1 New York), 3 of which were classified as fishery interactions (2 in Rhode Island and one in Massachusetts).

Table 3. Short-beaked common dolphin (*Delphinus delphis delphis*) reported strandings along the U.S. Atlantic coast, 2006-2010.

STATE	2006	2007	2008	2009	2010	TOTALS
Maine	0	1	0	0	1	2
Massachusetts[a]	100	65	19	53	71	308
Rhode Island[c]	2	4	3	6	7	22
New York [b, c]	3	23	2	7	9	44
New Jersey[c]	2	4	9	6	14	35
Delaware[c]	0	0	2	4	0	6

Maryland	0	0	2	2	0	4
Virginia[c]	1	4	20	2	5	32
North Carolina[c]	2	0	1	7	6	16
TOTALS	110	101	58	87	113	469

a. Massachusetts mass strandings (2006 - 2,2,3,4,4,3,9,10,14, and 14; 2007 - 9,2,4,6,2; 2008 - 5 and 2; 2009 - 2,3,3,4,6,8, 2010 - 2,2,3,3,3,4,5,8).

b. One common dolphin was released alive from a pound net in 2006 in New York. Twenty (12 dead, 8 rescued; one of the mortalities classified as human interaction) animals were involved in a mass stranding in Suffolk county in 2007. Seven animals were involved in 2 mass stranding events in March 2009 (six euthanized, 1 died at site, 2 had signs of fishery interation). In addition, in 2008 3 animals were relocated from the Nansemond River.

c. One 2006 mortality in Virginia and one 2007 mortality in New York were reported as having human interactions. Seven records were reported with signs of human interaction in 2008 - 3 from Virginia, 1 from Massachusetts, one from North Carolina, and one from Delaware. Of these, 4 were fishery interactions. Six human interaction cases were reported in 2009 (2 Massachusetts, 3 Rhode Island, 1 New York), 3 of which were classified as fishery interactions (2 in Rhode Island and one in Massachusetts). Seven HI cases were reported in 2010 (4 mortalities in MA, 2 released alive in RI, and 1 mortality in NJ), 2 of which (MA) were classified as fishery 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.

STATUS OF STOCK

The 2006-2010 average annual human-related mortality does not exceed PBR; therefore, this is not a strategic stock. The total U.S. 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. The status of short-beaked common dolphins, relative to OSP, in the U.S. Atlantic EEZ is unknown. There are insufficient data to determine the population trends for this species. The species is not listed as threatened or endangered under the Endangered Species Act. ~~There are insufficient data to determine the population trends for this species. The total U.S. fishery-related mortality and serious injury for this stock is not less than 10% of the calculated PBR and, therefore, cannot be considered to be insignificant and approaching zero mortality and serious injury rate. The 2005~~2006~~-2009~~ 2010 ~~average annual human-related mortality does not exceed PBR; therefore, this is not a strategic stock.~~

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

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

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

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

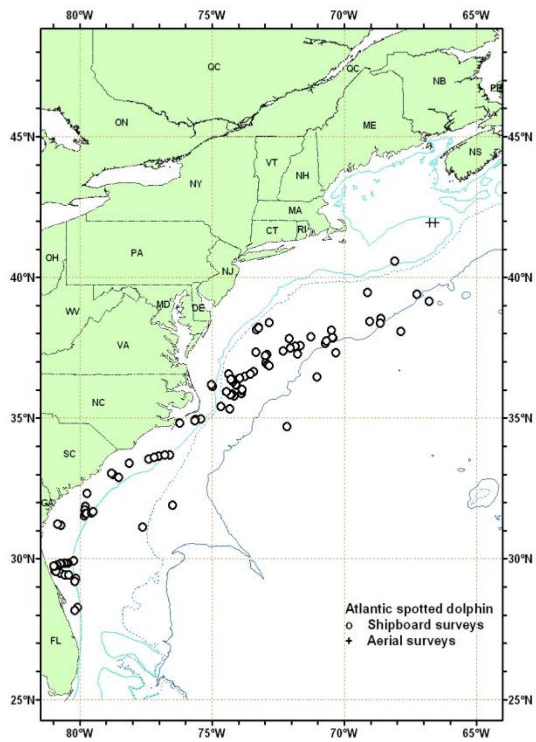

Figure 1. *Distribution of Atlantic spotted dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer in 1998 and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.*

POPULATION SIZE

Total numbers of Atlantic spotted dolphins off the U.S. or Canadian Atlantic coast are unknown, although estimates are available from selected regions for select time periods. Ssightings have been concentrated in the slope waters north of Cape Hatteras, but in the shelf waters south of Cape Hatteras sightings extend into the deeper slope and offshore waters of the mid-Atlantic (Fig. 1). The best recent abundance estimate for Atlantic spotted dolphins is the result of the 2011 survey—26,798 (CV= 0.66) sum of the estimates from the two 2004 western U.S. Atlantic surveys. This joint estimate (3,578+47,400=50,978) is considered best because these two surveys together have the most complete coverage of the species' habitat.

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

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions. ~~An abundance estimate of 6,107 undifferentiated spotted dolphins (CV=0.27) was obtained from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). An abundance estimate of 4,772 (CV=1.27) undifferentiated spotted dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence (Table 1; NMFS unpublished data). An abundance estimate of 32,043 (CV=1.39) Atlantic spotted dolphins was derived from a line-transect sighting survey conducted during July 6 to September 6, 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38° N). An abundance estimate of 14,438 (CV=0.63) Atlantic spotted dolphins was generated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38°N) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable and should not be used for PBR determinations.~~

Recent surveys and abundance estimates

An abundance estimate of 3,578 (CV= 0.48) Atlantic spotted dolphins was obtained from a line-transect sighting survey conducted during June 12 to August 4, 2004 by a ship and plane that surveyed 10,761 km of track line in waters north of Maryland (38°N) to the Bay of Fundy (45°N) (Figure 1; Palka Unpublished Ms.). Shipboard data were collected using the ~~two~~ two-~~independent~~ independent-team ~~line~~ 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~~ 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 Ms).

A survey of the U.S. Atlantic outer continental shelf and continental slope (water depths ≥50 m) between 27.5 – 38 ºN 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~~mid-Atlantic. The survey included 5,659 km of trackline, and accomplished a total of 473 cetacean sightings. Sightings were most frequent in waters North of Cape Hatteras, North Carolina along the shelf break. Data were corrected for visibility bias *g(0)* and group-size bias and analyzed using line-transect distance analysis (Palka 1995; Buckland *et al.* 2001). The resulting abundance estimate for Atlantic spotted dolphins between Florida and Maryland was 47,400 animals (CV=0.45).

An abundance estimate of 26,798 (CV= 0.66) Atlantic spotted dolphins was generated from a shipboard and aerial survey conducted during June-August 2011. The aerial portion covered 6,850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines that were in waters that were deeper than the 100-m depth contour out to beyond the US EEZ. Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). In addition, an abundance survey was conducted concurrently in the southern U.S. waters (from North Carolina to Florida). The abundance estimates from this southern survey are being calculated and are not available at this time.

. Summary of abundance estimates for the western North Atlantic spotted dolphins, *Stenella frontalis*, by month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV)

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to the Bay of Fundy	3,578	0.48
Jun-Aug 2004	Florida to Maryland	47,400	0.45
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	50,978	0.42
Jun-Aug 2011	North Carolina to lower Bay of Fundy	26,798	0.66

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 26,798 (CV= 0.66)~~50,978 (CV=0.42)~~. The minimum population estimates based on the ~~combined~~ 2011 abundance estimates is ~~36,2354,006~~16,151.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size for the Atlantic spotted dolphin is ~~36,2354,006~~16,151. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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~~162~~40~~.

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 ~~2001~~2006-~~2005~~ 2010 was ~~6 (CV=1)~~0.2 due to one animal in the stranding records that was struck by a boat. ~~Atlantic spotted dolphins (*Stenella frontalis*) (Table 2). Due to the potential uncertainty in differentiation between Atlantic spotted and pantropical spotted dolphins, fishery takes reported as either species are included below.~~

Earlier Interactions

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

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

~~**Pelagic Longline**~~

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

~~Summary of the incidental mortality and serious injury of Atlantic spotted dolphins (*Stenella frontalis*) by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).~~

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

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

Other Mortality

From ~~2001~~2006-~~2005~~2010, ~~16~~ 19 Atlantic spotted dolphins were stranded between Massachusetts and Puerto Rico (NMFS unpublished data). ~~Two animals stranded in North Carolina and 3 in Florida in 2001; 2 animals stranded in North Carolina and 2 in Florida in 2002; 1 animal stranded in 2003 in Massachusetts, North Carolina, and Florida;, one dolphin stranded in Florida and one in Puerto Rico in 2004; and one dolphin stranded in North Carolina and one in Georgia in 2005.~~ ~~None~~ One of these strandings had documented signs of fishery or human interactions—a Florida 2007 mortality with extensive propeller wounds.

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

Table 2. Atlantic spotted dolphin (Stenella frontalis) reported strandings along the U.S. Atlantic coast, ~~2001~~2006-~~2005~~2010.

STATE	~~2001~~2006	~~2002~~2007	~~2003~~2008	~~2004~~2009	~~2005~~2010	TOTALS

~~Massachusetts~~New York	0	0	~~1~~0	0	~~0~~1	1
New Jersey	0	0	0	0	1	1
Virginia	0	0	0	0	1	1
North Carolina	~~2~~1	~~2~~0	~~1~~1	~~0~~1	~~1~~6	~~6~~9
South Carolina	1	0	0	0	0	1
Georgia	0	~~0~~1	0	0	~~1~~0	1
Florida[a]	~~3~~0	2	~~1~~0	~~1~~2	0	~~7~~4
Puerto Rico	0	0	0	~~1~~0	~~0~~1	1
TOTALS	~~5~~2	~~4~~3	~~3~~1	~~2~~3	~~2~~10	~~16~~19

a. One of the 2007 Florida animals was classified as a boat strike, One of the 2009 animals live stranded and was transferred to rehab.

STATUS OF STOCK

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

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

The striped dolphin, *Stenella coeruleoalba*, is distributed worldwide in warm-temperate to tropical seas (Archer and Perrin 1997; Archer 2002). 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-Atlanticmid-Atlantic region (CETAP 1982; Mullin and Fulling 2003; Figure 1). Continental shelf edge sightings in this program were generally centered along the 1,000 m depth contour in all seasons (CETAP 1982). During 1990 and 1991 cetacean habitat-use surveys, striped dolphins were associated with the Gulf Stream north wall and warm-core ring features (Waring *et al.* 1992). Striped dolphins seen in a survey of the New England Sea Mounts (Palka 1997) were in waters that were between 20˚and 27˚C and deeper than 900 m.

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

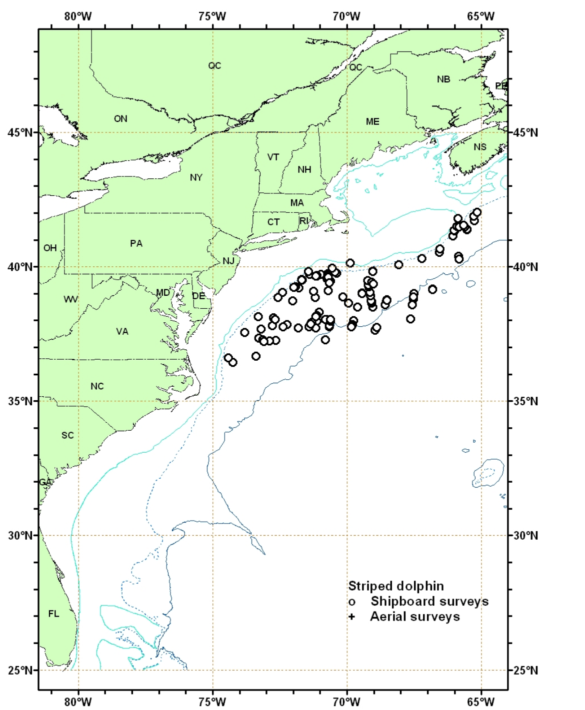

Figure 1. *Distribution of striped dolphin sightings from NEFSC and SEFSC shipboard and aerial surveys during the summer 1998, 1999, and 2004. Isobaths are at 100 m, 1,000 m, and 4,000 m.*

POPULATION SIZE

Total numbers of striped dolphins off the U.S. or Canadian Atlantic coast are unknown, although several estimates from selected regions are available for select time periods. Sightings are almost exclusively in the continental shelf edge and continental slope areas west of Georges Bank (Figure 1). The best abundance estimate for striped dolphins is the result of the sum of the estimates from the two 2004 U.S. Atlantic surveys,2011 survey— 94,46246,882 (CV=0.4033)), where the estimate from the northern U.S. Atlantic is 52,055 (CV=0.57), and from the southern U.S. Atlantic is 42,407 (CV=0.53). This joint estimate is considered best because together these two surveys have the most complete coverage of the species' habitat.

Earlier abundance estimates

An abundance estimate of 36,780 striped dolphins (CV=0.27) was obtained from an aerial survey program conducted from 1978 to 1982 on the continental, shelf and shelf edge waters between Cape Hatteras, North Carolina and Nova Scotia (CETAP 1982). Abundance estimates of 25,939 (CV=0.36) and 13,157 (CV=0.45) striped dolphins were obtained from line-transect aerial surveys conducted from August to September 1991 using the Twin Otter and AT-11aircraft (NMFS 1991). An abundance estimate of 31,669 (CV=0.73) striped dolphins was obtained from a July to September 1995 sighting survey conducted by two ships and an airplane that covered waters from Virginia to the mouth of the Gulf of St. Lawrence. An abundance estimate of 49,945 (CV=0.40) striped dolphins was obtained from the sum of the estimate of 39,720 (CV=0.45) striped dolphins from a line-transect sighting survey conducted during 6 July to 6 September 1998 by a ship and plane that surveyed 15,900 km of track line in waters north of Maryland (38ºN) (Palka 2006), and the estimate of 10,225 (CV=0.91) striped dolphins, estimated from a shipboard line-transect sighting survey conducted between 8 July and 17 August 1998 that surveyed 4,163 km of track line in waters south of Maryland (38ºN) (Mullin and Fulling 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates older than eight years are deemed unreliable, and should not be used for PBR determinations. Further, due to changes in survey methodology these data should not be used to make comparisons to more current estimates

Recent surveys and abundance estimates

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

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

An abundance estimate of 46,882 (CV=0.33) striped dolphins was generated from a shipboard and aerial survey conducted during Jun-Aug 2011. The aerial portion covered 6,850 km of tracklines that were over waters north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy. The shipboard portion covered 3,811 km of tracklines that were in water offshore of North Carolina to Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling ~~(MRDS)~~ option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009). Striped dolphins were also seen during the SEFSC summer 2011 abundance survey, which covered waters from North Carolina to Florida. –The abundance resulting from the SEFSC survey has currently not yet been estimated.

Table 1. Summary of abundance estimates for western North Atlantic striped dolphins. Month, year, and area covered during each abundance survey, and resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Aug 2004	Maryland to the Bay of Fundy	52,055	0.57
Jun-Aug 2004	Florida to Maryland	42,407	0.53
Jun-Aug 2004	Florida to Bay of Fundy (COMBINED)	94,462	0.40
Jun-Aug 2011	North Carolina to lower Bay of Fundy	46,882	0.33

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~~46,882 (CV=0.33) ~~(CV=0.40)~~ obtained from the ~~2004~~ 2011 surveys. The minimum population estimate for the western North Atlantic striped dolphin is ~~68,558~~~~38,373~~35,763.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

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

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~“recovery”~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is ~~68,558~~38,373. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~“recovery”~~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~~38~~4~~58.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Total annual estimated average fishery-related mortality to this stock during ~~2001~~2006-~~2005~~ 2010 was zero striped dolphins.

Fishery Information

Detailed fishery information is reported in Appendix III.

Earlier Interactions

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

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

USA

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

CANADA

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

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

Other Mortality

~~From 1995-1998, 7 striped dolphins were stranded between Massachusetts and Florida (NMFS unpublished data). From 1999-2003, fifty-nine dolphins were reported stranded from Maine to Florida (NMFS unpublished data). There were no signs of human interactions or mass strandings. The number of reported strandings per year were 2005 (16, including 12 from a mass stranding in North Carolina), 2004 (2), 2003 (19), 2002 (5), 2001 (9), 2000 (5), and 1999 (5).~~A total of 68 striped dolphins have been reported stranded along the U.S. Atlantic coast between 1995 and 2005 (NMFS unpublished data). This includes one record of a mass stranding of 12 animals in North Carolina in 2005. During the period 2006-2010, a total of 47 striped dolphins were reported stranded along the U.S. Atlantic coast (Table 2).

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

Table 3: Striped dolphin reported strandings along the U.S. Atlantic coast 2006-2010.

Stranding State	2006	2007	2008	2009	2010	**Total**
Maine	0	1	0	0	0	**1**
Massachusetts[a]	1	5	2	2	4	**14**
Rhode Island	0	0	1	0	1	**2**
New York	4	2	0	1	1	**8**
New Jersey[b]	1	2	7	0	2	**12**
Delaware	0	1	0	0	0	**1**
North Carolina[b]	1	3	2	2	0	**8**
Maryland	0	1	0	0	0	**1**
TOTALS	**7**	**15**	**12**	**5**	**8**	**47**

a. In 2007 one live stranding in Massachusetts was classified as a human interaction due to being pushed off the beach.

b. In 2008 one animal in New Jersey and one in North Carolina were classified as fishery interaction mortalities.

STATUS OF STOCK

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

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BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Northern North Carolina Estuarine System Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The coastal morphotype of bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, New York, to the Florida peninsula, including inshore waters of the bays, sounds and estuaries. Several lines of evidence support a distinction between dolphins inhabiting coastal waters near the shore and those present primarily in the inshore waters of the bays, sounds and estuaries. Photo-identification (photo-ID) and genetic studies support the existence of resident estuarine animals in several areas (Caldwell 2001; Gubbins 2002; Zolman 2002; Gubbins *et al.* 2003; Mazzoil *et al.* 2005; Litz 2007), and similar patterns have been observed in bays and estuaries along the Gulf of Mexico coast (Wells *et al.* 1987; Balmer *et al.* 2008). Recent genetic analyses using both mitochondrial DNA and nuclear microsatellite markers found significant differentiation between animals biopsied along the coast and those biopsied within the estuarine systems at the same latitude (NMFS unpublished data). Similar results have been found off the west coast of Florida (Sellas *et al.* 2005; Balmer *et al.* 2008).

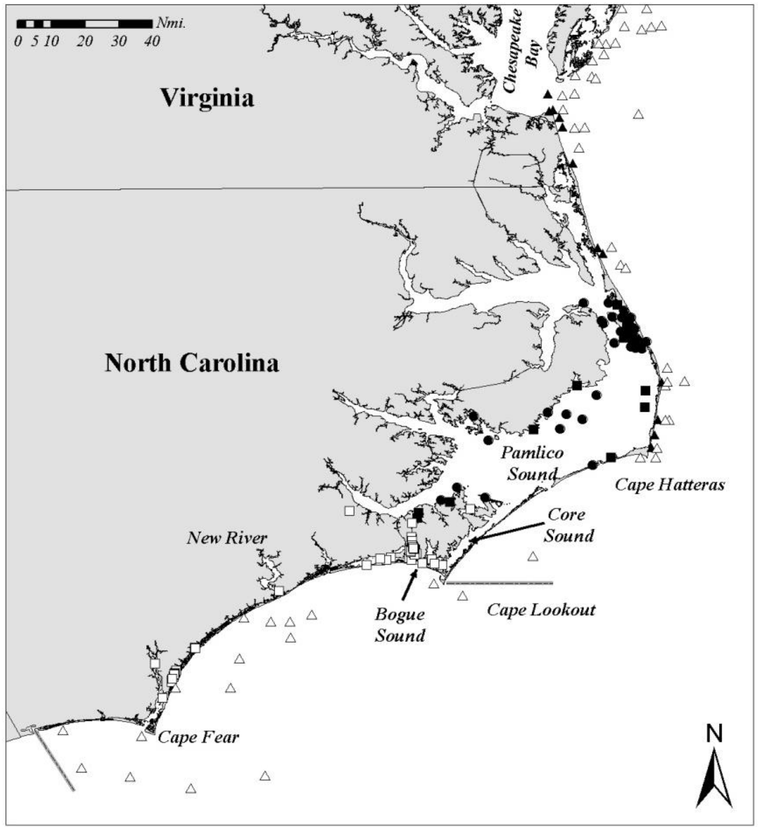

Figure 1. *The summer (July-September) distribution of bottlenose dolphins occupying coastal and estuarine waters in North Carolina and Virginia. Locations are shown from aerial surveys (triangles), satellite-linked telemetry (circles), and photo-identification studies (squares). Sightings assigned to the Northern North Carolina Estuarine System stock are shown with filled symbols. Photo-identification data are courtesy of Duke University and the University of North Carolina at Wilmington.*

The Northern North Carolina Estuarine System (NNCES) sStock is defined as animals that occupy estuarine waters of Pamlico Sound during summer months (July-August). The ranging patterns of bottlenose dolphins in photo-ID studies supports the presence of a group of dolphins within these waters that are distinct from both dolphins occupying estuarine and coastal waters in southern North Carolina and animals in the Northern and Southern Migratory sStocks that occupy coastal waters of North Carolina at certain times of the year (Read et al. 2003; NMFS 2001; NMFS unpublished data). In addition, stable isotope analysis of animals sampled along the beaches of North Carolina between Cape Hatteras and Bogue Inlet during February and March showed very low stable isotope ratios of ^{18}O relative to ^{16}O (referred to as "depleted oxygen", Cortese 2000). One explanation for the depleted oxygen signature is a resident group of dolphins in Pamlico Sound that move into nearby coastal waters in the winter (NMFS 2001). The estuarine waters of Pamlico Sound had previously been included in the abundance estimates and stock assessment reports for the Northern migratory stock and the winter "mixed" North Carolina management unit of coastal bottlenose dolphins (Waring et al. 2007). However, they are now recognized as a distinct stock based upon these differences in seasonal ranging patterns and stable isotope signatures.

The seasonal movements of the NNCES ~~s~~Stock are best described using a combination of ~~tag ~~telemetry and long-term photo-ID studies. Animals captured and released near Beaufort, North Carolina, were fitted with satellite-linked transmitters during November 1999 (3 animals), April 2000 (8 animals), and April 2006 (5 animals) (NMFS unpublished data). In addition, long-term photo-ID studies have been conducted in waters of North Carolina that include records of both these tagged animals and animals that were captured and freeze-branded near Beaufort, North Carolina, during summer months (Hansen and Wells 1996; Duke University unpublished data; University of North Carolina at Wilmington unpublished data; NMFS unpublished data). Of these tagged or freeze-branded animals, 18 occupied waters of northern Pamlico Sound during summer months and hence were identified as belonging to the NNCES ~~s~~Stock. The NNCES ~~s~~Stock occurs primarily within the waters of Pamlico Sound north of Core Sound during summer months (July-August). There is evidence that some of these animals also move into nearshore coastal waters along the northern coast of North Carolina and into coastal waters of Virginia and perhaps into Chesapeake Bay. One animal that was tagged near Virginia Beach in September 1998 was observed to move south into waters of Pamlico Sound and had a photo-ID record within the sound during July (NMFS unpublished data). In addition, there are photo-ID matches between inshore waters of Virginia Beach, Virginia, and Pamlico Sound (Urian, pers. comm.) that also demonstrate movements of NNCES animals between these areas. Therefore, it is presumed that the spatial range of NNCES animals during summer and fall months (July-October) includes Pamlico Sound, nearshore (<1km from shore) coastal waters of northern North Carolina, and nearshore and estuarine waters of Virginia (Figure 1).

There are fewer ~~tag ~~telemetry data for assigned NNCES animals during winter months. However, photo-ID studies, available tag data and stable isotope data indicate that the stock moves out of the waters of Pamlico Sound into coastal waters south of Cape Hatteras during late fall and through winter (November – April). ~~Tag t~~Telemetry records show that NNCES animals move as far south as the New River during winter months (January-February) (NMFS unpublished data). The Northern Migratory ~~s~~Stock also occupies the nearshore coastal waters of North Carolina during these months, and hence there is likely overlap between these stocks, particularly between Cape Hatteras and Cape Lookout.

The movements of animals from the NNCES ~~s~~Stock are distinct from those of the Southern North Carolina Estuarine System ~~s~~Stock (SNCES). Some of the animals tagged or freeze-branded near Beaufort moved south to Cape Fear and occupied nearshore coastal and estuarine waters during winter months. During summer and fall, these animals moved north and occupied inshore and nearshore coastal waters near Cape Lookout including Bogue Sound and Core Sound. It is probable that there is spatial overlap between these 2 estuarine stocks during late summer and fall in the waters near Beaufort. However, SNCES ~~s~~Stock animals were not observed to move north of Cape Lookout in coastal waters nor into the main portion of Pamlico Sound during summer (NMFS unpublished data; Duke University unpublished data; University of North Carolina at Wilmington unpublished data). These movement patterns are consistent with those in resightings of individual dolphins during a photo-ID study that sampled much of the estuarine waters of North Carolina (Read *et al.* 2003). Read *et al.* (2003) suggested that movement patterns, differences in group sizes, and habitats are consistent with 2 stocks of animals occupying estuarine waters of North Carolina. Finally, genetic analysis of samples from animals in waters of southern North Carolina (between Cape Lookout and the North Carolina/South Carolina border) demonstrate significant differentiation from animals occupying waters from Virginia and further north and waters of South Carolina (Rosel *et al.* 2009).

In summary, during summer and fall months (July-October), the NNCES ~~s~~Stock occupies waters of Pamlico Sound and nearshore coastal and estuarine waters of northern North Carolina to Virginia Beach (Figure 1). It likely overlaps with animals from the Southern Migratory ~~s~~Stock in coastal waters during these months. During late fall and winter (November-March), the NNCES ~~s~~Stock moves out of estuarine waters and occupies nearshore coastal waters between the New River and Cape Hatteras. It overlaps with the Northern Migratory ~~s~~Stock during this period, particularly between Cape Lookout and Cape Hatteras. It appears that the region near Cape Lookout including Bogue Sound and Core Sound is an area of overlap with the SNCES ~~s~~Stock during late summer.

POPULATION SIZE

Read et al. (2003) provided the first ~~and only available ~~abundance estimate of bottlenose dolphins that occur within the estuarine portion of the NNCES ~~s~~Stock range. This estimate was based on a photo-ID mark-recapture survey of a portion of North Carolina waters inshore of the barrier islands, conducted during July 2000. Because the survey did not sample all of the estuarine waters where dolphins are known to occur, the estimates of abundance may be negatively biased. Read et al. (2003) estimated the number of animals in the inshore waters of North

Carolina equivalent to that of the NNCES ~~s~~Stock to be 919 (95% CI 730 - 1,190, CV=0.13). Gubbins et al. (2003) also conducted a photo-ID mark-recapture study during 1997 and provided an abundance estimate (513, CV=0.13) for inshore and nearshore waters near Beaufort, North Carolina, but this area represented only a small portion of the NNCES ~~s~~Stock area and included animals in coastal waters. Goodman et al. (2007) conducted seasonal, strip-transect aerial surveys of southwestern Pamlico Sound from July 2004 through April 2006. Their survey area sampled approximately 25% or less of the waters within the NNCES ~~s~~Stock boundaries. Mean seasonal abundance estimates ranged from a low of 54 (CV=0.46) during June - August 2005 (summer), to a high of 426 (CV=0.35) during September - November 2004 (autumn), but seasonal patterns were not consistent among years. For example, the estimate for spring of 2005 was only 71 (CV=0.39) while the estimate for spring of 2006 was 323 (CV=0.35). ~~The abundance estimate from Read et al. (2003) is the best abundance estimate for the stock in estuarine waters; however, this estimate is more than 8 years old, and hence cannot be used to calculate N_{min} or PBR.~~

Since both t~~ag t~~elemetry studies and photo-identification records indicate that some portion of the NNCES ~~s~~Stock occurs in coastal waters between Cape Hatteras, North Carolina, and Virginia during summer months, it is appropriate to include animals from summer aerial surveys of these areas in the abundance estimate. Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. The surveys employed 2 observer teams operating independently on the same aircraft to estimate visibility bias. Abundance estimates were calculated using line transect methods and distance analysis (Buckland *et al.* 2001). The 2002 surveys included 2 teams of observers to derive a correction for visibility bias. The independent and joint estimates from the 2 survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct duplicate estimator (Palka 1995).

~~During the summer survey, 6,734km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia-Florida state line. A total of 185 bottlenose dolphin groups were sighted during summer including 2,544 individual animals.~~

~~In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20m and 20-40m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189km of trackline. There were a total of 140 sightings of bottlenose dolphins including 3,093 individual animals. During the summer of 2004, water temperatures were significantly cooler than those during 2002 and earlier surveys conducted in 1995, and animals distributed farther south and overlapped spatially. It is probable that both the Northern Migratory and Southern Migratory stocks occurred in waters of northern North Carolina during the summer of 2004.~~

~~The best~~An abundance estimate for the ~~Northern North Carolina Estuarine System~~NNCES ~~s~~Stock in coastal waters ~~is therefore~~was derived from the summer 2002 aerial survey~~ when there was less overlap among stocks~~. Survey data were post-stratified to estimate the abundance of dolphins within a strip extending from the shoreline to 1km from shore between Cape Lookout, North Carolina~~,~~ and Virginia Beach, Virginia. T~~ag t~~elemetry records indicated that NNCES animals rarely ventured further away from shore. However, animals from the Southern Migratory ~~s~~Stock do occur within this strip during summer months. Therefore, the estimate of abundance within this strip includes both NNCES animals and Southern Migratory animals and hence overestimates abundance The resulting best abundance estimate for the NNCES ~~s~~Stock in coastal waters ~~is~~ was 468 (CV=0.32).

~~The best available~~The abundance estimate for the NNCES ~~s~~Stock during 2000-2002 ~~is~~ was the combined abundance from estuarine and coastal waters. This combined estimate is 1,387 (CV=0.17). ~~However, this estimate includes data that are more than 8 years old from Read *et al.* (2003). Hence, the abundance of the NNCES stock is currently unknown.~~

A photo-ID mark-recapture study was conducted in 2006 using similar methods to those in Read *et al.* (2003) which included estuarine waters from Core Sound to Albemarle Sound. ~~-~~A boundary line between the NNCES ~~s~~Stock and the neighboring SNCES Stock was identified at 34°46' N Latitude, and this boundary is consistent with the descriptions of the ranges of the 2 stocks during summer months. ~~-~~The survey also included coastal waters extending up to 1~~-~~km from shore, which is also consistent with the current understanding of the distribution of this stock. ~~-~~The survey did not include estuarine and coastal waters north of Albemarle Sound, and it is therefore possible that some portion of the NNCES ~~s~~Stock was outside of the boundaries of the current survey. ~~-~~Thus, the updated abundance estimate is most likely negatively biased. ~~-~~The resulting abundance estimate includes a correction for the proportion of dolphins with non-distinct fins in the population. ~~-~~The abundance estimate for the NNCES Stock based upon photo-ID mark-recapture surveys in 2006 was 950 animals (CV = 0.23, 95% Confidence Interval = 516-1,384; Urian *et al*., unpublished manuscript). ~~-~~This is the best available abundance estimate for the NNCES ~~s~~Stock.

Minimum Population Estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by Wade and Angliss (1997). The best estimate of abundance for the NNCES Stock is 950 (CV=0.23). The minimum population estimate for the NNCES Stock is 785. ~~Because the only available comprehensive abundance for this stock is derived from data that are more than 8 years old, they may not be used to calculate the minimum population estimate, and as a result the minimum population estimate for the NNCES stock of bottlenose dolphins is unknown.~~

Current Population Trend

There are insufficient data to determine the population trends for this stock. However, Urian *et al.* (unpublished manuscript) noted that there was no statistically significant difference between abundance estimates within estuarine waters from the surveys conducted during 2000 and those conducted during 2006.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. 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 the minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the NNCES ~~s~~Stock of bottlenose dolphins ~~is unknown~~is 785. 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. ~~-~~The resulting PBR for this stock is 7.9 animals.~~PBR for this stock of bottlenose dolphins is undetermined.~~

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Fishery Information

The NNCES ~~s~~Stock interacts with 3 Category II fisheries: the Atlantic blue crab trap/pot fishery, North Carolina long haul seine fishery and North Carolina inshore gillnet fishery. There is no systematic federal observer coverage of these fisheries by the National Marine Fisheries Service (NMFS), although the North Carolina Division of Marine Fisheries operates systematic coverage of the fall flounder gillnet fishery in Pamlico Sound (Price 2008). As a result, information about interactions with North Carolina inshore fisheries is based solely on stranding data and it is not possible to estimate the annual number of interactions or mortalities in these fisheries. The NNCES ~~s~~Stock may also interact with the mid-Atlantic gillnet fishery, the mid-Atlantic haul/beach seine fishery and the Virginia Pound Net fishery. The magnitude of the interaction with each of these fisheries is unknown because of both uncertainty in the movement patterns of the stock and the spatial overlap between the NNCES ~~s~~Stock and other bottlenose dolphin stocks in coastal waters. The total estimated average annual fishery mortality on the NNCES ~~s~~Stock ranges between a minimum of 4.1 and a maximum of 22.6 animals per year. This range reflects the uncertainty in assigning observed or reported mortalities to a particular stock.

~~Mid-Atlantic~~mid-Atlantic Gillnet

This fishery has the highest documented level of mortality of coastal morphotype bottlenose dolphins, and the sink gillnet gear in North Carolina is its largest component in terms of fishing effort and observed takes. Of 12 observed mortalities between 1995 and 2000, 5 occurred in sets targeting spiny or smooth dogfish, 1 was in a set targeting "shark" species, 2 occurred in striped bass sets, 2 occurred in Spanish mackerel sets, and the remainder were in sets targeting kingfish, weakfish or finfish generically (Rossman and Palka 2001). From 2001-2008, 7 additional bottlenose dolphin mortalities were observed in the mid-Atlantic gillnet fishery. Three mortalities were observed in 2001 with 1 occurring off of northern North Carolina during April and 2 occurring off of Virginia during November. Four additional mortalities were observed along the North Carolina coast near Cape Hatteras: 1 in May 2003, 1 in September 2005, 1 in September 2006, and 1 in October 2006. Because the Northern Migratory, Southern Migratory, Northern North Carolina Estuarine System and Southern North Carolina Estuarine System bottlenose dolphin stocks all occur in waters off of North Carolina, it is not possible to definitively assign all observed mortalities, or extrapolated bycatch estimates, to a specific stock. In addition, the Bottlenose Dolphin Take Reduction Plan (TRP) was implemented in May 2006 resulting in changes in the gear configurations and other characteristics of the fishery.

To estimate the mortality of bottlenose dolphins in the mid-Atlantic gillnet fishery, the available data were divided into the period from 2002 through April 2006 (pre-TRP) and from May 2006 – 2008 (post-TRP). Three alternative approaches were used to estimate bycatch rates. First, a generalized linear model (GLM) approach was used similar to that described in Rossman and Palka (2001). This approach included all observed mortalities from 1995-2008 where the fishing gear was still in use during the period from 2002-2008. Second, a simple ratio estimator of catch per unit effort (CPUE = observed catch / observed effort) was used based directly upon the observed data. Finally, a ratio estimator pooled across years was used to estimate different CPUE values for the pre-TRT and post-TRT periods. In each case, the annual reported fishery effort (represented as reported landings) was multiplied by the estimated bycatch rate to develop annual estimates of fishery-related mortality, again similar to the approach in Rossman and Palka (2001). To account for the uncertainty in the most appropriate of these 3 alternative approaches, the average of the 3 model estimates (and the associated uncertainty) are used to estimate the mortality of bottlenose dolphins for this fishery (Table 1). It should be noted that the extrapolated estimates of total mortality include landings from inshore waters where the NNCES sStock is likely to occur.

Table 1. Summary of the 2002-2008 incidental mortality of bottlenose dolphins (*Tursiops truncatus*) in the Northern North Carolina Estuarine System sStock in the commercial mid-Atlantic coastal gillnet fisheries. The estimated annual and average mortality estimates are shown for the period prior to the implementation of the Bottlenose Dolphin Take Reduction Plan (pre-TRP) and after the implementation of the plan (post-TRP). Three alternative modeling approaches were used, and the average of the 3 was used to represent mortality estimates. The minimum and maximum estimates indicate the range of uncertainty in assigning observed bycatch to stock. Observer coverage is measured as a proportion of reported landings (tons of fish landed). Data are derived from the Northeast Observer program, NER dealer data, and NCDMF dealer data. Values in parentheses indicated the CV of the estimate.

Period	Year	Observer Coverage[a]	Min Annual Ratio	Min Pooled Ratio	Min GLM	Max Annual Ratio	Max Pooled Ratio	Max GLM
pre-TRP	2002	0.01	0	0	15.64 (0.63)	0	39.45 (0.92)	33.69 (0.38)
	2003	0.01	0	0	11.03 (0.58)	49.46 (0.94)	12.77 (0.92)	19.29 (0.36)
	2004	0.02	0	0	12.10 (0.62)	0	28.46 (0.92)	28.42 (0.34)
	2005	0.03	0	0	11.84 (0.60)	0	22.58 (0.92)	23.01 (0.37)
	Jan-Apr 2006	0.03	0	0	1.40 (0.50)	0	0	1.99 (0.37)

Annual Avg. pre-TRP			Minimum: 3.47 (CV=0.30)			Maximum: 19.79 (CV=0.11)		
post-TRP	May-Dec 2006	0.03	0	0	5.08 (0.42)	73.37 (0.69)	18.84 (0.68)	12.46 (0.36)
	2007	0.03	0	0	8.32 (0.43)	0	24.47 (0.68)	18.77 (0.34)
	2008	0.01	0	0	8.14 (0.42)	0	21.91 (0.68)	16.77 (0.34)
Annual Avg. post-TRP			Minimum: 2.39 (CV=0.25)			Maximum: 18.99 (CV=0.11)		
[a] Observer coverage is reported on an annual basis for the entire fishery as a proportion of the reported tons of fish landed.								

There have been 3 observed takes in the mid-Atlantic gillnet fishery since 2001 that could potentially be assigned to the Northern North Carolina Estuarine System sStock. However, in each of these cases, the take could potentially be assigned to the Southern Migratory sStock since they occurred in near-shore coastal waters of northern North Carolina. Since observed mortalities (and effort) cannot be definitively assigned to a particular stock within certain regions and times of year, the minimum and maximum possible mortality on the NNCES sStock are presented for comparison to PBR (Table 1).

Based upon these analyses, the minimum mortality estimate for the NNCES sStock for the pre-TRP period was 3.47 (CV=0.30) animals per year, and that for the post-TRP period was 2.39 (CV=0.25) animals per year. The maximum estimates were 19.79 (CV=0.11) for the pre-TRP period and 18.99 (CV=0.11) for the post-TRP period (Table 1).

Beach Haul Seine/Beach-based Gillnet Gear

Two coastal bottlenose dolphin takes were observed in beach haul seine gear: 1 in May 1998 and 1 in December 2000. These takes occurred during a striped bass fishery within the spatial and seasonal range of the Northern Migratory sStock. Beach-based gillnet gear is now considered part of the Mid-Atlanticmid-Atlantic gillnet fishery described above; however, it is not included in the observer program or resulting mortality estimates. Data from the Southeast Region Stranding Network from 2002-2008 include 2 confirmed reports of bottlenose dolphin mortalities in beach-based gillnet gear for striped bass during winter months off the coast of northern North Carolina: 1 in December 2002 and 1 in January 2008. A third possible mortality associated with this gear occurred during December 2002 (Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). Based upon their location and time of year, these mortalities were most likely animals from the Northern Migratory sStock rather than the NNCES sStock since they occurred north of Cape Hatteras in winter months.

Crab Pots and Other Pots

Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab pots. However, it is clear that interactions with pot gear are a common occurrence and result in mortalities of coastal morphotype bottlenose dolphins in some regions (Burdett and McFee 2004). Southeast Regional Marine Mammal Stranding Network data (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009) from 2004 through 2008 include 13 reports of interactions between bottlenose dolphins and confirmed blue crab pot gear with the majority of these occurring in waters from Florida to South Carolina. In addition, there were 4 interactions documented with pot gear where the fishery could not be confirmed. In these cases, the gear was confirmed to be associated with a pot or trap, but may have been from a fishery other than blue crab (e.g., whelk fisheries in Virginia). Of the confirmed blue crab pot interactions, there was 1 reported mortality in this 5 year period in waters of Virginia and North Carolina. This case occurred in August 2004 and is most likely assigned to the NNCES

~~s~~Stock. There was 1 mortality in pot gear where the fishery type could not be confirmed in Virginia. This mortality was reported in August 2007 and could be assigned to either the Southern Migratory or the NNCES ~~s~~Stock.

Virginia and North Carolina Pound Nets

Historical and recent stranding network data report interactions between bottlenose dolphins and pound nets in Virginia. Stranding data for 2004-2008 indicate 17 cases where bottlenose dolphins were removed from pound net gear, and it was determined that animals were entangled pre-mortem. In each case, the bottlenose dolphin was recovered directly from the fishing gear. Of these 17 cases, 14 were documented mortalities while 3 were released alive (S. Barco, Virginia Aqua~~u~~rium, unpublished data; Northeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). These interactions occurred primarily inside estuarine waters near the mouth of the Chesapeake Bay and in summer months. Nine of these mortalities occurred during the summer (July-September) when they could have impacted either the Southern Migratory or the Northern North Carolina Estuarine System ~~s~~Stocks. The overall impact of the Virginia Pound Net fishery on the Northern North Carolina Estuarine System ~~s~~Stock is unknown due to the limited information on the stock's movements, particularly whether or not it occurs within waters inside the mouth of the Chesapeake Bay. In addition, 1 bottlenose dolphin was recovered dead from pound net gear in North Carolina during August 2004. This mortality is most likely assigned to the NNCES ~~s~~Stock.

Other Mortality

There have been occasional mortalities of bottlenose dolphins during research activities including both directed live capture studies and fisheries surveys. From 2002-2009, there have been 15 reported interactions during research activities resulting in 13 documented mortalities of bottlenose dolphins. A mortality occurring in a turtle relocation trawl off of North Carolina during March 2002 could have been attributed to either the Southern Migratory ~~s~~Stock or the NNCES ~~s~~Stock. One mortality in a research beach seine was reported from June 2007 in northern North Carolina that was consistent with the spatial range of the Northern Migratory ~~s~~Stock, the Southern Migratory ~~s~~Stock or the NNCES ~~s~~Stock. Finally, a mortality was observed in July 2007 in a research net in the Neuse River that is most likely from the NNCES ~~s~~Stock.

Three bottlenose dolphins that were captured, tagged with satellite-linked transmitters, and released near Beaufort, North Carolina, during April 2006 by the NMFS as part of a long-term stock delineation research project were believed to have died shortly thereafter as a result of the capture or tagging (NMFS unpublished data). Two of the animals were recovered stranded but because of advanced decomposition of the carcasses cause of death could not be determined. One of these 2 animals was known from long-term photo-ID and was likely of the Southern North Carolina Estuarine System ~~s~~Stock. The third animal has not been observed subsequent to release, but patterns in the data received from its satellite tag were similar to that of the other 2 and indicated the fates were similar. These last 2 animals were, based on satellite-derived locations, most likely from the NNCES ~~s~~Stock. All known human-caused mortalities including both commercial fisheries and research related mortalities are summarized in Table 2.

This stock inhabits areas with significant drainage from agricultural, industrial and urban sources, and as such is exposed to contaminants in runoff from those sources. The blubber of 47 bottlenose dolphins captured and released in and around Beaufort contained detectable environmental contaminants~~t levels of some level~~, and 7 had unusually high levels of the pesticide methoxychlor (Hansen *et al.* 2004). While there are no estimates of indirect human-caused mortality from pollution or habitat degradation, Schwacke *et al.* (2002) found that the levels of polychlorinated biphenyls (PCBs) observed in Beaufort female bottlenose dolphins would likely impair reproductive success, especially of primiparous females.

Table 2. Summary of annual reported and estimated mortality of bottlenose dolphins from the Northern North Carolina Estuarine System ~~s~~Stock. Where minimum and maximum values are reported, there is uncertainty in the assignment of mortalities to this particular stock due to spatial overlap with other bottlenose dolphin stocks in certain areas and seasons. The reported mortalities in Virginia Pound Net, beach-based gillnet and crab pot fisheries are confirmed reports and are likely an underestimate of total mortalities in these fisheries.

Year	~~Mid-Atlantic~~mid-Atlantic Gillnet	Virginia Pound Net[a]	Beach-based Gillnet	Blue Crab Pot	Other Pot	Research	Total
2004	Min = 4.0 Max= 18.9	Min = 1 Max = 4	0	1	0	0	Min = 6.0 Max = 23.9
2005	Min = 4.0 Max= 15.2	Min = 0 Max = 1	0	0	0	0	Min = 4.0 Max = 16.2
2006	Min = 2.2 Max = 35.6	Min = 0 Max = 2	0	0	0	2	Min = 4.2 Max = 39.6
2007	Min = 2.8 Max = 14.4	Min = 0 Max = 1	0	0	Min = 0 Max = 1	Min = 1 Max = 2	Min = 3.8 Max = 18.4
2008	Min = 2.7 Max = 12.9	Min = 0 Max = 2	0	0	0	0	Min = 2.7 Max = 14.9
Annual Average Mortality (2004-2008)				Minimum Estimated = 4.1 Maximum Estimated = 22.6			
[a] Pound nets also include a mortality observed in North Carolina in 2004.							

Strandings

Between 2004 and 2008, 422 bottlenose dolphins stranded along the Atlantic coast in North Carolina and Virginia that could be assigned to the NNCES ~~s~~Stock (Table 3; Northeast Regional Marine Mammal Stranding Network, Southeast Regional Marine Mammal Stranding Network; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). The assignment of animals to a particular stock is impossible in some seasons and regions, particularly in coastal waters of North Carolina and Virginia. Therefore, it is likely that the counts below include some animals from either the Southern Migratory or Northern Migratory ~~s~~Stocks. Within estuarine waters of North Carolina, where the probability is very high that strandings are from the NNCES ~~s~~Stock, there were a total of 73 strandings in this 5 year period. In addition, stranded carcasses are not routinely identified to either the offshore or coastal morphotype of bottlenose dolphin, therefore it is possible that some of the reported strandings were of the offshore form. In most cases, it was not possible to determine if a human interaction had occurred due to the decomposition state of the stranded animal. However, in cases where a determination could be made, the incidence of evidence of fisheries interactions was high. In cases where a determination could be made, 65% of stranded animals from Virginia, 41% of cases from coastal waters of North Carolina and 82% (14/17) of cases from North Carolina estuarine waters had evidence of human interaction. It should be recognized that evidence of human interaction does not indicate cause of death, but rather only that there was evidence of interaction with a fishery (e.g., line marks, net marks).

Table 3. Strandings of bottlenose dolphins from North Carolina and Virginia that can possibly be assigned to the Northern North Carolina Estuarine System (NNCES) ~~s~~Stock. Strandings observed in North Carolina are separated into those occurring within Pamlico Sound and other estuaries (Estuary) vs. coastal waters. Assignments to stock were based upon the understanding of the seasonal movements of this stock. However, particularly in coastal waters, there is likely overlap between the NNCES ~~s~~Stock and other bottlenose dolphin stocks. HI = Evidence of Human Interaction, CBD = Cannot Be Determined whether an HI occurred or not. NOAA National Marine Mammal Health and Stranding Response

Database unpublished data, accessed 21 September 2009 and 18 November 2009

State	2004			2005			2006			2007			2008		
Type	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD	HI Yes	HI No	CBD
North Carolina - Coastal	6	8	25	7	7	41	1	7	25	5	8	26	5	5	28
North Carolina- Estuary	6	1	9	2	0	7	4	2	11	2	0	19	0	0	10
Virginia[a]	13	5	10	7	9	13	9	3	17	6	3	19	8	1	22
Annual Total	83			93			79			88			79		

[a] Strandings from Virginia include primarily waters inside Chesapeake Bay during late summer through fall. It is likely that the NNCES ~~s~~Stock overlaps with the Southern ~~m~~Migratory ~~s~~Stock in this area.

STATUS OF STOCK

From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event, and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).

The status of the NNCES ~~s~~Stock 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 population trends for this stock. The annual average of human caused mortality for this stock ranges between a minimum of 4.1 and a maximum of 22.6, but this is an underestimate of total mortality associated with commercial fisheries. ~~The most recent abundance estimate is greater than 8 years old, and therefore PBR is undetermined.~~ The calculated PBR is 7.9 animals; therefore, it is possible that mortality in commercial fisheries exceeds PBR for this stock. ~~–~~However, because mortality cannot be reliably assigned to stocks, it is currently not possible to evaluate the status relative to PBR. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. However, the total human-caused mortality and serious injury is most likely greater than 10% of PBR and may ~~approach or~~ exceed PBR. Because ~~the stock size is currently unknown, and~~ relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.

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HARBOR PORPOISE (*Phocoena phocoena phocoena*): Gulf of Maine/Bay of Fundy Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

This stock is found in U.S. and Canadian Atlantic waters. The distribution of harbor porpoises has been documented by sighting surveys, strandings and takes reported by NMFS observers in the Sea Sampling Program. During summer (July to September), harbor porpoises are concentrated in the northern Gulf of Maine and southern Bay of Fundy region, generally in waters less than 150 m deep (Gaskin 1977; Kraus *et al.* 1983; Palka 1995a; Palka 1995b), with a few sightings in the upper Bay of Fundy and on Georges Bank (Palka 2000). During fall (October-December) and spring (April-June), harbor porpoises are widely dispersed from New Jersey to Maine, with lower densities farther north and south. They are seen from the coastline to deep waters (>1800 m; Westgate *et al.* 1998), although the majority of the population is found over the continental shelf. During winter (January to March), intermediate densities of harbor porpoises can be found in waters off New Jersey to North Carolina, and lower densities are found in waters off New York to New Brunswick, Canada. There does not appear to be a temporally coordinated migration or a specific migratory route to and from the Bay of Fundy region. However, during the fall, several satellite tagged harbor porpoises did favor the waters around the 92-m isobath, which is consistent with observations of high rates of incidental catches in this depth range (Read and Westgate 1997). There were two stranding records from Florida during the 1980s (Smithsonian strandings database) and one in 2003 (NE Regional Office/NMFS strandings and entanglement database).

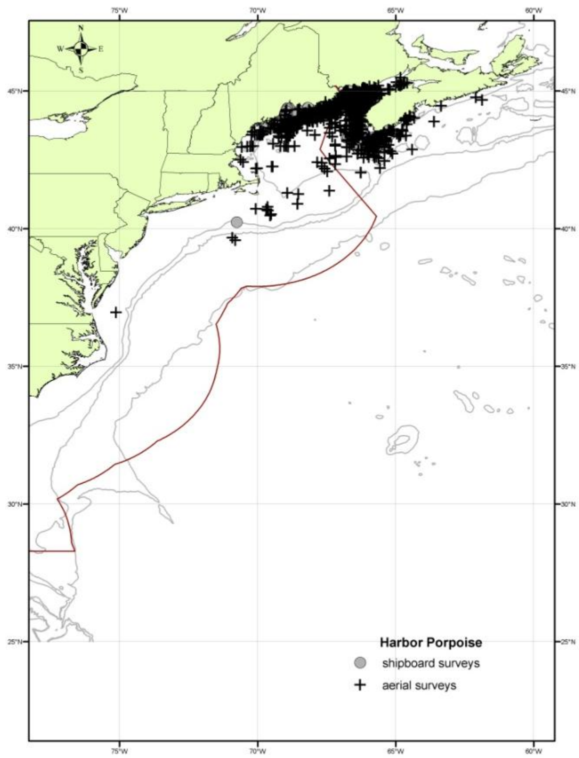

Figure 1. *Distribution of harbor porpoises from NEFSC and SEFSC shipboard and aerial surveys during the summers of 1995, 1998, 1999, 2002, 2004, 2006, ~~and~~ 2007, 2008, and 2010. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

Gaskin (1984, 1992) proposed that there were four separate populations in the western North Atlantic: the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, Newfoundland, and Greenland populations. Analyses involving mtDNA (Wang *et al.* 1996; Rosel *et al.* 1999a; 1999b), organochlorine contaminants (Westgate *et al.* 1997; Westgate and Tolley 1999), heavy metals (Johnston 1995), and life history parameters (Read and Hohn 1995) support Gaskin's proposal. Genetic studies using mitochondrial DNA (Rosel *et al.* 1999a) and contaminant studies using total PCBs (Westgate and Tolley 1999) indicate that the Gulf of Maine/Bay of Fundy females were distinct from females from the other populations in the Northwest Atlantic. Gulf of Maine/Bay of Fundy males were distinct from Newfoundland and Greenland males, but not from Gulf of St. Lawrence males according to studies comparing mtDNA (Palka *et al.* 1996; Rosel *et al.* 1999a) and CHLORs, DDTs, PCBs and CHBs (Westgate and Tolley 1999). Nuclear microsatellite markers have also been applied to samples from these four populations, but this analysis failed to detect significant population sub-division in either sex (Rosel *et al.* 1999a). These patterns may be indicative of female philopatry coupled with dispersal of males. Both mitochondrial DNA and microsatellite analyses indicate that the Gulf of Maine/Bay of Fundy stock is not the sole contributor to the aggregation of porpoises found off the mid-Atlantic states during winter (Rosel *et al.* 1999a; Hiltunen 2006). Mixed-stock analyses using twelve microsatellite loci in both Bayesian and likelihood frameworks indicate that the Gulf of Maine/Bay of Fundy is the largest contributor (~60%), followed by Newfoundland (~25%) and then the Gulf of St. Lawrence (~12%), with Greenland making a small contribution (<3%). For Greenland, the lower confidence interval of the likelihood analysis includes zero. For the Bayesian analysis, the lower 2.5% posterior quantiles include zero for both Greenland and the Gulf of St. Lawrence. Intervals that reach zero provide the possibility that these populations contribute no animals to the mid-Atlantic aggregation. This report follows Gaskin's hypothesis on harbor porpoise stock structure in the western North Atlantic, where the Gulf of Maine and Bay of Fundy harbor porpoises are recognized as a single management stock separate from harbor porpoise populations in the Gulf of St. Lawrence, Newfoundland, and Greenland.

POPULATION SIZE

To estimate the population size of harbor porpoises in the Gulf of Maine/Bay of Fundy region,~~ eight~~ line-transect sighting surveys were conducted during the summers of 1991, 1992, 1995, 1999, 2002, 2004, 2006, ~~and~~ 2007, and 2011. The best current abundance estimate of the Gulf of Maine/Bay of Fundy harbor porpoise stock is the result of the 2011 survey—61,959 (CV=0.32).~~89,054 (CV=0.47), based on the 2006 survey results (Table 1). This is because the 2006 estimate covered the largest portion of the harbor porpoise range.~~

Earlier abundance estimates

Please see Appendix IV for a summary of abundance estimates, including earlier estimates and survey descriptions.

~~Please see Appendix IV for earlier abundance estimates. As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), if estimates are older than eight years PBR is undetermined.~~

Recent surveys and abundance estimates

An abundance estimate of 51,520 (CV=0.65) harbor porpoises was obtained from a line-transect sighting survey conducted during 12 June to 4 August 2004 by a ship and plane that surveyed 6,180 km of trackline from the 100-m depth contour on the southern Georges Bank to the lower Bay of Fundy. The Scotian shelf south of Nova Scotia was not surveyed (Table 1). Shipboard data were collected using the two-independent-team line-transect method and analyzed using the modified direct-duplicate method (Palka 1995b) 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 trackline. Aerial data were collected using the Hiby circle-back line-transect method (Hiby 1999) and analyzed accounting for *g(0)* and biases due to school size and other potential covariates (Palka 2005).

An abundance estimate of 89,054 (CV=0.47) harbor porpoises was generated from an aerial survey conducted in August 2006 which surveyed 10,676 km of trackline in the region from the 2000-m depth contour on the southern edge of Georges Bank to the upper Bay of Fundy and to the entrance of the Gulf of St. Lawrence. (Table 1; NMFS 2006).

An abundance estimate of 16,058~~4,862~~ (~~95%CI=2,204-8,801~~CV=0.50) harbor porpoises from the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, and Newfoundland stocks was generated from the Canadian Trans North Atlantic Sighting Survey ~~(T-NASS)~~ in July-August 2007 (and see Lawson and Gosselin 2009). This aerial survey covered area from northern Labrador to the Scotian Shelf, providing full coverage of the Atlantic Canadian coast. The abundance estimates from this survey have been corrected for perception and availability bias, when possible. In general, this involved correcting for perception bias using mark-recapture distance sampling (MCDS), and correcting for availability bias using dive/surface times, as reported in the literature, and the Laake (2007) analysis method (Lawson and Gosselin 2011).~~Estimates from this survey have not yet been corrected for availability and perception biases (Lawson and Gosselin 2009).~~.

An abundance estimate of 61,959 (CV=0.32) harbor porpoises was generated from a shipboard and aerial survey conducted during Jun - Aug 2011. The aerial portion~~ed~~ covered 6,850 km of tracklines that were over waters ~~from Massachusetts to New Brunswick, Canada (waters~~ north of New Jersey and shallower than the 100-m ~~depth contour,~~depth contour through the U.S. and Canadian Gulf of Maine and up to and including the lower Bay of Fundy~~)~~. The shipboard portion~~ed~~ covered 3,811 km of tracklines that were in water offshore of North Carolina to

Massachusetts (waters that were deeper than the 100-m depth contour out to beyond the U.S. EEZ). Both sighting platforms used a two-simultaneous team data collection procedure, which allows estimation of abundance corrected for perception bias of the detected species (Laake and Borchers, 2004). Estimation of the abundance was based on the independent observer approach assuming point independence (Laake and Borchers 2004) and calculated using the mark-recapture distance sampling (MRDS) option in the computer program Distance (version 6.0, release 2, Thomas *et al.* 2009).

Table 1. Summary of recent abundance estimates for the Gulf of Maine/Bay of Fundy harbor porpoise. Month, year, and area covered during each abundance survey and the resulting abundance estimate (N_{best}) and coefficient of variation (CV).

Month/Year	Area	N_{best}	CV
Jun-Jul 2004	Gulf of Maine to lower Bay of Fundy	51,520	0.65
Aug 2006	S. Gulf of Maine to upper Bay of Fundy to Gulf of St. Lawrence	89,054	0.47
Jul-Aug 2007	Northern Labrador Scotian Shelf and Gulf of St. Lawrence[a]	12,7324, 862	0.6131
Jul-Aug 2011	North Carolina to lower Bay of Fundy	61,959	0.32

a. Estimate includes harbor porpoises from the Gulf of Maine/Bay of Fundy, Gulf of St. Lawrence, and Newfoundland stocks

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 harbor porpoises is 61,95989,054 (CV=0.4732). The minimum population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 60,97074,68647,635,959.

Current Population Trend

A trend analysis has not been conducted for this species.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Several attempts have been made to estimate potential population growth rates. Barlow and Boveng (1991), who used a re-scaled human life table, estimated the upper bound of the annual potential growth rate to be 9.4%. Woodley and Read (1991) used a re-scaled Himalayan tahr life table to estimate a likely annual growth rate of 4%. In an attempt to estimate a potential population growth rate that incorporates many of the uncertainties in survivorship and reproduction, Caswell *et al.* (1998) used a Monte Carlo method to calculate a probability distribution of growth rates. The median potential annual rate of increase was approximately 10%, with a 90% confidence interval of 3-15%. This analysis underscored the considerable uncertainty that exists regarding the potential rate of increase in this population. Moore and Read (2008) conducted a Bayesian population modeling analysis to estimate the potential population growth of harbor porpoise in the absence of bycatch mortality. Their method used fertility data, in combination with age-at-death data from stranded animals and animals taken in gillnets, and was applied under two scenarios to correct for possible data bias associated with observed bycatch of calves. Demographic parameter estimates were 'model averaged' across these scenarios. The Bayesian posterior median estimate for potential natural growth rate was 0.046. This last, most recent, value will be the one used for the purpose of this assessment.

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a "recovery"recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is 60,97074,68647,635,959. The maximum productivity rate is 0.046. The “recovery”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 CV of the average mortality estimate is less than 0.3 (Wade and Angliss 1997). PBR for the Gulf of Maine/Bay of Fundy harbor porpoise is 703859548931.

ANNUAL HUMAN-CAUSED MORTALITY

Data to estimate the mortality and serious injury of harbor porpoise come from U.S. and Canadian Sea Sampling Programs, from records of strandings in U.S. and Canadian waters, and from records in the Marine Mammal Authorization Program (MMAP). See Appendix III for details on U.S. fisheries and data sources. Estimates using Sea Sampling Program and MMAP data are discussed by fishery under the Fishery Information section (Table 2). Strandings records are discussed under the Unknown Fishery in the Fishery Information section (Table 3) and under the Other Mortality section (Table 3).

The total annual estimated average human-caused mortality is 927 8407 harbor porpoises per year. This is derived from two components: 803796883 798 harbor porpoise per year (CV=0.1415) from U.S. fisheries using observer and MMAP data, and 44 per year (unknown CV) from Canadian fisheries using observer data.

Fishery Information

Recently, Gulf of Maine/Bay of Fundy harbor porpoise takes have been documented in the U.S. Northeast sink gillnet, mid-Atlantic gillnet, and Northeast bottom trawl fisheries and in the Canadian Bay of Fundy groundfish sink gillnet and herring weir fisheries (Table 2). Detailed U.S. fishery information is reported in Appendix III.

Earlier Interactions

One harbor porpoise was observed taken in the Atlantic pelagic drift gillnet fishery during 1991-1998; the fishery ended in 1998. This observed bycatch was notable because it occurred in continental shelf edge waters adjacent to Cape Hatteras (Read *et al.* 1996). Estimated annual fishery-related mortality (CV in parentheses) attributable to this fishery was 0.7 in 1989 (7.00), 1.7 in 1990 (2.65), 0.7 in 1991 (1.00), 0.4 in 1992 (1.00), 1.5 in 1993 (0.34), 0 during 1994-1996 and 0 in 1998. The fishery was closed during 1997.

U.S.

Northeast Sink Gillnet

In 1990, an observer program was started by NMFS to investigate marine mammal takes in the Northeast sink gillnet fishery (Appendix III). Bycatch in the northern Gulf of Maine occurs primarily from June to September, while in the southern Gulf of Maine, bycatch occurs from January to May and September to December. Estimated annual bycatch (CV in parentheses) from this fishery was 2,900 in 1990 (0.32), 2,000 in 1991 (0.35), 1,200 in 1992 (0.21), 1,400 in 1993 (0.18) (CUD 1994; Bravington and Bisack 1996), 2,100 in 1994 (0.18), 1,400 in 1995 (0.27) (Bisack 1997), 1,200 in 1996 (0.25), 782 in 1997 (0.22), 332 in 1998 (0.46), 270 in 1999 (0.28) (Rossman and Merrick 1999), 507 in 2000 (0.37), 53 (0.97) in 2001, 444 (0.37) in 2002, 592 (0.33) in 2003, 654 (0.36) in 2004, 630 (0.23) in 2005, 514 (0.31) in 2006, 395 (0.37) in 2007, 666 (0.48) in 2008, and 591 (0.23) in 2009, and 408 (0.28) in 2010 (Table 2). There appeared to be no evidence of differential mortality in U.S. or Canadian gillnet fisheries by age or sex in animals collected before 1994, although there was substantial inter-annual variation in the age and sex composition of the bycatch (Read and Hohn 1995). Using observer data collected during 1990-1998 and a logit regression model, females were 11 times more likely to be caught in the offshore southern Gulf of Maine region, males were more likely to be caught in the south Cape Cod region, and the overall proportion of males and females caught in a gillnet and brought back to land were not significantly different from 1:1 (Lamb 2000).

Scientific experiments that demonstrated the effectiveness of pingers in the Gulf of Maine were conducted during 1992 and 1993 (Kraus *et al.* 1997). After the scientific experiments, experimental fisheries were allowed in the general fishery during 1994 to 1997 in various parts of the Gulf of Maine and south of Cape Cod areas. During these experimental fisheries, bycatch rates of harbor porpoises in pingered nets were less than in non-pingered nets.

A study on the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage which took place in both the Northeast and Mid-Atlanticmid-Atlantic gillnet fisheries. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´) in February, March and April. Eight research strings of fourteen nets each were fished and, 159 hauls were completed during the course of the 2009 study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Twelve harbor porpoises were caught in this project during 2009 (Schnaittacher 2011) and another ~~twelve~~10 were caught during the 2010 experiment. These animals were included in the observed interactions and added to the total estimates (Table 2), though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Average estimated harbor porpoise mortality and serious injury in the Northeast sink gillnet fishery during 1994-1998, before the Take Reduction Plan, was 1,163 (0.11). The average annual harbor porpoise mortality and serious injury in the Northeast sink gillnet fishery from ~~2005~~ 2006 to ~~2009~~ 2010 was ~~559~~ 515 (0.~~16~~175) (Table 2).

~~Mid-Atlantic~~mid-Atlantic Gillnet

Before an observer program was in place for this fishery, Polacheck *et al.* (1995) reported one harbor porpoise incidentally taken in shad nets in the York River, Virginia. In July 1993 an observer program was initiated in the mid-Atlantic gillnet fishery by the NEFSC Sea Sampling program (Appendix III). Documented bycatch after 1995 was from December to May. Bycatch estimates were calculated using methods similar to that used for bycatch estimates in the Northeast sink gillnet fishery (Bravington and Bisack 1996; Bisack 1997). The estimated annual mortality (CV in parentheses) attributed to this fishery was 103 (0.57) for 1995, 311 (0.31) for 1996, 572 (0.35) for 1997, 446 (0.36) for 1998, 53 (0.49) for 1999, 21 (0.76) for 2000, 26 (0.95) for 2001, unknown in 2002, 76 (1.13) in 2003, 137 (0.91) in 2004, 470 (0.51) in 2005, 511 (0.32) in 2006, 58 (1.03) in 2007, 350 (0.75) in 2008, ~~and~~ 201 (0.55) in 2009, and 2~~60~~59 (0.88) in 2010.

In the Northeast gillnet fishery section above, see the description of the study on the effects of two different hanging rations in the bottom-set gillnet fishery which took place in both the Northeast and ~~Mid-Atlantic~~mid-Atlantic gillnet fisheries. Harbor porpoises that were caught in this study were included in the observed interactions and added to the total estimates (Table 2), though these animals and the fishing effort from this experiment were not included in the estimation of the bycatch rate that was expanded to the rest of the fishing effort.

Annual average estimated harbor porpoise mortality and serious injury from the mid-Atlantic gillnet fishery during 1995 to 1998, before the Take Reduction Plan, was 358 (CV=0.20). The average annual harbor porpoise mortality and serious injury in the mid-Atlantic gillnet fishery from ~~2005~~ 2006 to ~~2009~~ 2010 was ~~318~~ 276 (0.~~26~~29) (Table 2).

Northeast Bottom Trawl

This fishery is active in New England waters in all seasons. Twenty harbor porpoise mortalities were observed in the Northeast bottom trawl fishery between 1989 and 2008, but many of these are not attributable to this fishery. Decomposed animals are presumed to have been dead prior to being taken by the trawl. One fresh dead take was observed in the Northeast bottom trawl fishery in 2003, 4 in 2005, 1 in 2006, and 1 in 2008. Estimates have not been generated for this fishery. To estimate bycatch in this fishery, observer and mandatory vessel trip report data from the years 2005 through 2009 were used in a stratified ratio-estimator. The estimated annual mortality (CV in parentheses) attributed to this fishery was 7.2 (0.48) for 2005, 6.5 (0.49) for 2006, 5.6 (0.46) for 2007, 5.3 (0.47) for 2008, ~~and~~ 5.1 (0.50) for 2009, and 0~~na~~ for 2010. Annual average estimated harbor porpoise mortality and serious injury from the northeast bottom trawl fishery from ~~2005~~ 2006 to ~~2009~~ 2010 is 4.5 (0.30) ~~was 6.0 (0.22)~~ ~~is not available~~ (Table 2).

Unknown Fishery

The strandings and entanglement database, maintained by the New England Aquarium and the Northeast Regional Office/NMFS, reported 228, 27, 113, 79, 122, 118, 175, 73, 79, 58, and 65 stranded harbor porpoises on U.S. beaches during 1999 to 2009, respectively (see Other Mortality section for more details). Of these, it was determined that the cause of death of 19, 1, 3, 2, 9, and 6 stranded harbor porpoises in 1999 to 2004, respectively, were due to unknown fisheries and these animals were in areas and times that were not included in the above mortality estimate derived from observer program data.

CANADA

Hooker *et al.* (1997) summarized bycatch data from a Canadian fisheries observer program that placed observers on all foreign fishing vessels operating in Canadian waters, on 25-40% of large Canadian fishing vessels (greater than 100 feet long), and on approximately 5% of smaller Canadian fishing vessels. No harbor porpoises were observed taken.

Bay of Fundy Sink Gillnet

During the early 1980s, harbor porpoise bycatch in the Bay of Fundy sink gillnet fishery, based on casual observations and discussions with fishermen, was thought to be low. The estimated harbor porpoise bycatch in 1986 was 94-116 and in 1989 it was 130 (Trippel *et al.* 1996). The Canadian gillnet fishery occurs mostly in the western portion of the Bay of Fundy during the summer and early autumn months, when the density of harbor porpoises is highest. Polacheck (1989) reported there were 19 gillnetters active in 1986, 28 active in 1987, and 21 in 1988.

A~~More recently, a~~n observer program implemented in the summer of 1993 provided a total bycatch estimate of 424 harbor porpoises (± 1 SE: 200-648) from 62 observed trips, (approximately 11.3% coverage of the Bay of Fundy trips) (Trippel *et al.* 1996). During 1994, the observer program was expanded to cover 49% of the gillnet trips (171 observed trips). The bycatch was estimated to be 101 harbor porpoises (95% confidence limit: 80-122), and the fishing fleet consisted of 28 vessels (Trippel *et al.* 1996). During 1995, due to groundfish quotas being exceeded, the gillnet fishery was closed from July 21 to August 31. During the open fishing period of 1995, 89% of the trips were observed, all in the Swallowtail region. Approximately 30% of these observed trips used pingered nets. The estimated bycatch was 87 harbor porpoises (Trippel *et al.* 1996). No confidence interval was computed due to lack of coverage in the Wolves fishing grounds. During 1996, the Canadian gillnet fishery was closed during 20-31 July and 16-31 August due to groundfish quotas. From the 107 monitored trips, the bycatch in 1996 was estimated to be 20 harbor porpoises (DFO 1998; Trippel *et al.* 1999). Trippel *et al.* (1999) estimated that during 1996, gillnets equipped with acoustic alarms reduced harbor porpoise bycatch rates by 68% over nets without alarms in the Swallowtail area of the lower Bay of Fundy. During 1997, the fishery was closed to the majority of the gillnet fleet during 18-31 July and 16-31 August, due to groundfish quotas. In addition a time-area closure to reduce porpoise bycatch in the Swallowtail area occurred during 1-7 September. From the 75 monitored trips, 19 harbor porpoises were observed taken. After accounting for total fishing effort, the estimated bycatch in 1997 was 43 animals (DFO 1998). Trippel *et al.* (1999) estimated that during 1997, gillnets equipped with acoustic alarms reduced harbor porpoise bycatch rates by 85% over nets without alarms in the Swallowtail area of the lower Bay of Fundy. The number of monitored trips (and observed harbor porpoise mortalities were 111 (5) for 1998, 93 (3) for 1999, 194 (5) for 2000, and 285 (39) for 2001. The estimated annual mortality estimates were 38 for 1998, 32 for 1999, 28 for 2000, and 73 for 2001 (Trippel and Shepherd 2004). Estimates of variance are not available.

There has been no observer program during the summer since 2002 in the Bay of Fundy region, but the fishery is still~~was~~ active. Bycatch for these years is unknown. The annual average of most recent five years with available data (1997-2001) was 43 animals, so this value is used to estimate the annual average for more recent years. However, in 2011 there was little gillnet effort in New Brunswick waters in the summer; thus the porpoise by-catch estimates would have been near zero. The fishermen that sought groundfish went into the mid-Bay of Fundy where traditionally by-catch levels are extremely low. Trippel (pers. comm.) estimated that less than 10 porpoise were bycaught in the Canadian fisheries in the Bay of Fundy in 2011. Analysis of port catch records might allow estimation of bycatch rates for the 2002-2010 period.

Herring Weirs

Harbor porpoises are taken in Canadian herring weirs, but there have been no recent efforts to observe takes in the U.S. component of this fishery. Smith *et al.* (1983) estimated that in the 1980s approximately 70 harbor porpoises became trapped annually and, on average, 27 died annually. In 1990, at least 43 harbor porpoises were trapped in Bay of Fundy weirs (Read *et al.* 1994). In 1993, after a cooperative program between fishermen and Canadian biologists was initiated, over 100 harbor porpoises were released alive (Read *et al.* 1994). Between 1992 and 1994, this cooperative program resulted in the live release of 206 of 263 harbor porpoises caught in herring weirs. Mortalities (and releases) were 11 (50) in 1992, 33 (113) in 1993, and 13 (43) in 1994 (Neimanis *et al.* 1995). Since that time, additional ~~751~~ harbor porpoises have been documented in Canadian herring weirs~~ of which 728 were released or escaped, 42 died, and 29 had an unknown status~~; m~~. M~~ortalities (and releases, and unknowns) were 5 (60, 0) in 1995; 2 (4, 0) in 1996; 2 (24, 0) in 1997; 2 (26, 0) in 1998; 3 (89, 0) in 1999; 0 (13, 0) in 2000 (A. Read, pers. comm), 14 (296, 0) in 2001, 3 (46, 4) in 2002, 1 (26, 3) in 2003, 4 (53, 2) in 2004; 0 (19, 5) in 2005; 2 (14, 0) in 2006; 3 (9, 3) in 2007, 0 (8, 6) in 2008, ~~and~~ 0 (3,4) in 2009, and 1 in 2010 (7, 0) (Neimanis *et al.* 2004; H. Koopman and A. Westgate, pers. comm.).

Average estimated harbor porpoise mortality in the Canadian herring weir fishery during ~~2005~~2006-~~2009~~ 2010 was 1.20 (Table 2). An estimate of variance is not possible.

Gulf of St. Lawrence gillnet

This fishery interacts with the Gulf of St. Lawrence harbor porpoise stock, not the Gulf of Maine/Bay of Fundy harbor porpoise stock. Using questionnaires to fishermen, Lesage *et al.* (2006) determined a total of 2215 (95% CI 1151-3662) and 2394 (95% CI 1440-3348) harbor porpoises were taken in 2000 and 2001, respectively. The largest takes were in July and August around Miscou and the North Shore of the Gulf of St. Lawrence. According to the returned questionnaires, the fish species most usually associated with incidental takes of harbor porpoises include Atlantic cod, herring and mackerel. An at-sea observer program was also conducted during 2001 and 2002. However, due to low observer coverage that was not representative of the fishing effort, Lesage *et al.* (2006) concluded that resulting bycatch estimates were unreliable.

Newfoundland gillnet

This fishery interacts with the Newfoundland harbor porpoise stock, not the Gulf of Maine/Bay of Fundy harbor porpoise stock. Estimates of incidental catch of small cetaceans, where the vast majority are likely harbor porpoises was 862 in 2001, 1,428 in 2002, and 2,228 in 2003 for the Newfoundland nearshore cod and Greenland halibut fisheries, and the Newfoundland offshore fisheries in lumpfish, herring, white hake, monkfish and skate (Benjamins *et al.* 2007).

Table 2. From observer program data, summary of the incidental mortality of Gulf of Maine/Bay of Fundy harbor porpoise (*Phocoena phocoena phocoena*) by commercial fishery including the years sampled (Years), 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	Data Type [a]	Observer Coverage [b]	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
U.S.							
Northeast Sink Gillnet [c, h]	0506-0910	Obs. Data, Weighout, Trip Logbook	.07, .04, .07, .05, .04, .17	51, 26, 35, 30, 45, 5044	630, 514, 395, 666, 591, 44408	.23, .31, .37, .48, .23, .3128	559515 (0.1617)
Mid-Atlanticmid-Atlantic Gillnet	0506-09010	Obs. Data Weighout	.03, .04, .06, .03, .03, .04	15, 20, 1, 9, 7, 198	470, 511, 58, 350, 201, 26059	.51, .32, 1.03, .75, .55, .88	318276 (.29)
Northeast bottom trawl [g]	0506-0910	Obs. Data Weighout	.12, .06, .06, .08, .09, .16	4, 1, 0, 1, 0, 0	7.18, 6.548, 5.659, 5.326, 5.10, 0na	.48, .49, .46, .47, .50, 0na	4.5 (0.30)na6 (0.22)[g]
U.S. TOTAL	20052006-20092010						883803796798 (0.15) (0.14)
CANADA							
Bay of Fundy Sink Gillnet [d,f]	1997-2001	Can. Trips	unk	19, 5, 3, 5, 39	43, 38, 32, 28, 73	unk	43[f] (unk)
Herring Weir[e]	0506-0910	Coop. Data	unk	0, 2, 3, 0, 0, 1	0, 2, 3, 0, 0, 1	NA	1.02 (unk)
CANADIAN TOTAL	20052006-20092010						44 (unk)
GRAND TOTAL							9278472840 (unk)

NA = Not available.

a. Observer data (Obs. Data) are used to measure bycatch rates; the U.S. data are collected by the Northeast Fisheries Science Center (NEFSC) Sea Sampling Program and At-Sea Monitoring Program, the Canadian data are collected by DFO. NEFSC collects Weighout (Weighout) landings data that are used as a measure of total effort for the U.S. gillnet fisheries. The Canadian DFO catch and effort statistical system collected the total number of trips fished by the Canadians (Can. Trips), which was the measure of total effort for the Canadian groundfish gillnet fishery. Mandatory vessel trip report (VTR) (Trip Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery. Observed mortalities from herring weirs are collected by a cooperative program between fishermen and Canadian biologists (Coop. Data).

b. Observer coverage for the U.S. Northeast and mid-Atlantic coastal gillnet fisheries, is based on tons of fish landed.

c. Since~~During~~ 2002~~-2009~~ in the Northeast gillnet fishery, harbor porpoises were taken on pingered strings within strata that required pingers but that stratum also had observed strings without pingers. For estimates made during 1998 and after, a weighted bycatch rate was applied to effort from both pingered and non-pingered hauls within a stratum. The weighted bycatch rate was:

$$\sum_{i}^{ping,non-ping} \frac{\# porpoise_i}{sslandings_i} \frac{\# hauls_i}{total\ \# hauls}$$

There were 10, 33, 44, 0, 11, 0, 2, 8, 6, 2, 26, 2, 4, 12, 2, 9, 6,~~, and~~ 11, and 23 observed harbor porpoise takes on pinger trips from 1992 to 2010~~09~~, respectively, that were included in the observed mortality column. In addition, there were 9, 0, 2, 1,1, 4, 0, 1, 7, 21, 33, 24, 7, 13, and 20 observed harbor porpoise takes in 1995 to 2009, respectively, on trips dedicated to fish sampling versus dedicated to watching for marine mammals; these were also included in the observed mortality column (Bisack 1997).

d. There were 255 licenses for herring weirs in the Canadian Bay of Fundy region.

e. Data provided by H. Koopman pers. comm.

f. The Canadian gillnet fishery was not observed during 2002 and afterwards, but the fishery is still active; thus, the current bycatch estimate for this fishery is assumed to be the average estimate using last five years that the fishery was observed in (1997-2001)~~estimated using past averages~~.

g. Mortality estimates derived from takes observed by traditional fishery observers only.~~Fisheries observer data from the years 2005 through 2009 were pooled and bycatch rates for harbor porpoise were estimated using a stratified ratio-estimator. Estimated bycatch rates from the pooled fisheries observer data were expanded by annual (2005-2009) fisheries data collected from mandatory vessel trip reports .~~

h. Twenty-~~four~~two ~~welve~~ harbor porpoises were incidentally caught as part of a 2009-2010 NEFSC hanging ratio study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. These animals were included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in the estimation of the bycatch rate that was expanded to the rest of the fishery~~ calculations~~.

Other Mortality

U.S.

There is evidence that harbor porpoises were harvested by natives in Maine and Canada before the 1960s, and the meat was used for human consumption, oil, and fish bait (NMFS 1992). The extent of these past harvests is unknown, though it is believed to have been small. Up until the early 1980s, small kills by native hunters (Passamaquoddy Indians) were reported. In recent years it was believed to have nearly stopped (Polacheck 1989) until media reports in September 1997 depicted a Passamaquoddy tribe member dressing out a harbor porpoise. Further articles describing use of porpoise products for food and other purposes were timed to coincide with ongoing legal action in state court.

During 2005, 175 harbor porpoises were reported stranded on Atlantic U.S. beaches. Although 24 animals were classified as having signs of human interaction, and of those 24, 7 showed signs of fishery interaction, in no case was cause of death directly attributable to these interactions. An Unusual Mortality Event was declared for harbor porpoise in North Carolina, as there were 38 stranded in that state between 1 January and 28 March 2005. Most of these were young of the year, and histopathological examinations of 6 of these animals showed no systemic diseases or common symptoms other than emaciation (MMC 2006).

During 2006, 73 harbor porpoises were reported stranded on Atlantic U.S. beaches. Eight of these were reported as having signs of human interaction, but in no case was cause of death directly attributable to these interactions. In fact, in three cases the human interaction was post-mortem. One of the human interaction mortalities was classified as a fishery interaction (with no further detail), one as a boat collision, and one was involved in an oil spill.

During 2007, 79 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, six were reported as having signs of human interaction. One of these was classified as a fishery interaction, and one had signs of propeller wounds, although the marks appeared to have been made post-mortem.

During 2008, 58 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, four were reported as having signs of human interaction. One of these was classified as a fishery interaction.

During 2009, 65 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, five stranding mortalities were reported as having signs of human interaction, all of which were fishery interactions.

During 2010, 64 harbor porpoises were reported stranded on Atlantic U.S. beaches. Of these, five stranding mortalities were reported as having signs of human interaction, two of which were reported to be fishery interactions.

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

~~Table 3. Harbor Porpoise (*Phocoena phocoena phocoena*) reported strandings along the U.S. Atlantic coast and Nova Scotia, 2005-2009.~~

~~Area~~	~~Year~~					~~Total~~
	~~2005~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	
~~Maine~~	~~9~~	~~9~~	~~10~~	~~7~~	~~4~~	~~**39**~~
~~New Hampshire~~	~~0~~	~~1~~	~~0~~	~~0~~	~~0~~	~~**1**~~
~~Massachusetts[a]~~	~~55~~	~~23~~	~~22~~	~~25~~	~~19~~	~~**144**~~
~~Rhode Island[b]~~	~~6~~	~~3~~	~~1~~	~~1~~	~~1~~	~~**12**~~
~~Connecticut~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~**1**~~
~~New York[c]~~	~~15~~	~~11~~	~~10~~	~~3~~	~~9~~	~~**48**~~
~~New Jersey[e]~~	~~17~~	~~6~~	~~5~~	~~8~~	~~4~~	~~**40**~~
~~Pennsylvania~~	~~1~~	~~0~~	~~0~~	~~0~~	~~1~~	~~**2**~~
~~Delaware~~	~~3~~	~~3~~	~~3~~	~~0~~	~~0~~	~~**9**~~
~~Maryland~~	~~4~~	~~2~~	~~0~~	~~2~~	~~5~~	~~**13**~~
~~Virginia[e]~~	~~22~~	~~9~~	~~8~~	~~6~~	~~8~~	~~**53**~~
~~North Carolina[d]~~	~~42~~	~~6~~	~~20~~	~~6~~	~~14~~	~~**88**~~
~~Florida~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~**0**~~
~~**TOTAL U.S.**~~	~~**175**~~	~~**73**~~	~~**79**~~	~~**58**~~	~~**65**~~	~~**450**~~
~~Nova Scotia[f]~~	~~5~~	~~4~~	~~4~~	~~6~~	~~6~~	~~**25**~~
~~Newfoundland and New Brunswick[g]~~	~~5~~	~~0~~	~~1~~	~~4~~	~~2~~	~~**12**~~
~~**GRAND TOTAL**~~	~~**185**~~	~~**77**~~	~~**84**~~	~~**68**~~	~~**73**~~	~~**487**~~

~~a. In Massachusetts, during 2005, 2 animals were relocated and released. In 2006 one stranding record was of an emaciated calf swimming in shallow water, but capture attempts were unsuccessful. One animal was taken to a rehab facility in 2007 and one in 2008.~~

~~b. In Rhode Island one animal stranded alive in 2006 and was taken to rehab.~~

c. Includes one live animal in 2006 in New York.
d. In North Carolina, one animal was relocated and released in 2005, one animal was taken to rehab in 2006, and one animal immediately released in 2008.
e. In 2009, 3 harbor porpoises were classified as fishery interactions, 2 in VA and 1in NJ.
f. Two of the 2009 animals were released alive.
g. One of the 2009 animals was released alive and the other was entangled dead in a capelin trap mooring.

Table 34. Harbor Porpoise (*Phocoena phocoena phocoena*) reported strandings along the U.S. Atlantic U.S. and Canadian coasts and Nova Scotia, 2006-2010.

Area	Year					Total
	2006	2007	2008	2009	2010	
Maine[f]	9	10	7	4	7	**37**
New Hampshire	1	0	0	0	5	**6**
Massachusetts[a, f]	23	22	25	19	28	**117**
Rhode Island[b]	3	1	1	1	0	**6**
New York[c]	11	10	3	9	1	**34**
New Jersey[e, f]	6	5	8	4	7	**30**
Pennsylvania	0	0	0	1	0	**1**
Delaware	3	3	0	0	2	**8**
Maryland	2	0	2	5	4	**13**
Virginia[e]	9	8	6	8	10	**41**
North Carolina[d]	6	20	6	14	0	**46**
TOTAL U.S.	**73**	**79**	**58**	**65**	**64**	**339**
Nova Scotia	4	4	6	6	5	**25**
Newfoundland and New Brunswick	0	1	4	2	1	**8**
GRAND TOTAL	**77**	**84**	**62**	**73**	**70**	**366**

a. In Massachusetts, during 2006 one stranding record was of an emaciated calf swimming in shallow water, but capture attempts were unsuccessful. One animal was taken to a rehab facility in 2007 and one in 2008.

b. In Rhode Island one animal stranded alive in 2006 and was taken to rehab.

c. Includes one live animal in 2006 in New York.

d. In North Carolina, one animal was taken to rehab in 2006, and one animal immediately released in 2008.
e. In 2009, 3 harbor porpoises were classified as fishery interactions, 2 in VA and a third in NJ.

f. Five total HI cases in 2010, 2 in MA, 1 in ME and 2 in NJ. One of tthe NJ records and the ME record were fishery interactions.

CANADA

The Nova Scotia Stranding Network documented whales and dolphins stranded between 1991 and 1996 on the coast of Nova Scotia (Hooker *et al.* 1997). Researchers with the Canadian Department of Fisheries and Oceans documented strandings on the beaches of Sable Island during 1970 to 1998 (Lucas and Hooker 2000). Sable Island is approximately 170 km southeast of mainland Nova Scotia. On the mainland of Nova Scotia, a total of 8 stranded harbor porpoises were recorded between 1991 and 1996: 1 in May 1991, 2 in 1993 (July and September), 1 in August 1994 (released alive), 1 in August 1994, and 3 in 1996 (March, April, and July (released alive)). On Sable Island, 8 stranded dead harbor porpoises were documented, most in January and February; 1 in May 1991, 1 in January 1992, 1 in January 1993, 3 in February 1997, 1 in May 1997, and 1 in June 1997. Two strandings during May-June 1997 were neonates (> 80 cm). The harbor porpoises that stranded in the winter (January-February) were on Sable Island, those in the spring (March to June) were in the Bay of Fundy (2 in Minas Basin and 1 near Yarmouth) and on Sable Island (2), and those in the summer (July to September) were scattered along the coast from the Bay of Fundy to Halifax.

Whales and dolphins stranded since ~~between~~ 1997 ~~and 2009~~ on the coast of Nova Scotia were recorded by the Marine Animal Response Society and the Nova Scotia Stranding Network, including 3 harbor porpoises stranded in 1997 (1 in April, 1 in June and 1 in July), 2 stranded in June 1998, 1 in March 1999, 3 in 2000 (1 in February, 1 in June, and 1 in August); 2 in 2001 (1 in July and 1 in December), 5 in 2002 (3 in July (1 released alive), 1 in August, and 1 in September (released alive)), 3 in 2003 (2 in May (1 was released alive) and 1 in June (disentangled and released alive)), 4 in 2004 (1 in April, 1 in May, 1 in July (released alive) and 1 in November), 6 in 2005 (1 in April (released alive), 1 in May, 3 in June and 1 in July), 4 in 2006 (1 in June, 1 in August, 1 in September, and 1 in December), 4 in 2007, 6 in 2008, ~~and~~ 6 in 2009 (2 released alive), and 5 (one released alive) in 2010; Table 3).

Five dead stranded harbor porpoises were reported in 2005 by the Newfoundland and Labrador Whale Release and Strandings Program, 1 in 2007 and 4 in 2008, ~~and~~ 2 in 2009 (one dead entangled and one live release), and 1 in 2010 (Ledwell and Huntington 2004; 2006; 2007; 2008; 2009; 2010, 2011; Table 3).

USA management measures taken to reduce bycatch

A ruling to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was published in the Federal Register (63 FR 66464) on 02 December 1998 and became effective 01 January 1999. The Gulf of Maine portion of the Harbor Porpoise Take Reduction Plan(HPTRP) pertains to all fishing with sink gillnets and other gillnets capable of catching regulated groundfish in New England waters, from Maine through Rhode Island. This portion of the rule includes time and areas closures, some of which are complete closures; others are closed to gillnet fishing unless pingers are used in the prescribed manner. Also, the rule requires those who intend to fish to attend training and certification sessions on the use of the technology. The mid-Atlantic portion of the plan pertains to waters west of 72º30'W longitude to the mid-Atlantic shoreline from New York to North Carolina. This portion of the rule includes time and area closures, some of which are complete closures; others are closed to gillnet fishing unless the gear meets certain restrictions. The MMPA mandates that the take reduction teams that developed the above take reduction measures periodically meet to evaluate the effectiveness of the plan and modify it as necessary. The Harbor Porpoise Take Reduction Team was reconvened in December 2007 to discuss updated harbor porpoise abundance and bycatch information. The Team recommended modifications to the plan to further reduce harbor porpoise bycatch in commercial fisheries. As a result, the HPTRP was amended on 19 February 2010 (75 FR 7383) to expand management areas and seasons in which pingers are required, as well as to increase efforts to monitor and enforce the plan. In addition, the New England portion of the HPTRP now includes consequence closure areas as a management measure strategy. These areas with historically high bycatch rates will close seasonally only if bycatch rates over two consecutive management seasons exceed a specified bycatch rate. This management strategy is intended to reduce harbor porpoise bycatch and to increase compliance with HPTRP regulations. Once triggered, these areas would remain in effect until bycatch levels achieve zero mortality rate goal (ZMRG) or until new management measures are implemented in these areas. ~~The compliance rate with the 1998 HPTRP regulations, was calculated for the 2008-2009 fishing season to be 53.2% (51.9%, in the northeast gillnet fishery and 56.3% in the mid-Atlantic gillnet fishery; Orphanides 2010).~~

STATUS OF STOCK

This is a strategic stock because average annual human-related mortality and serious injury exceed~~s~~ PBR. The total U.S. 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. The status of harbor porpoises, relative to OSP, in the U.S. Atlantic EEZ is unknown. Population trends for this species have not been investigated. On 7 January 1993, NMFS proposed listing the Gulf of Maine harbor porpoise as threatened under the Endangered Species Act (NMFS 1993). On 5 January 1999, NMFS determined the proposed listing was not warranted (NMFS 1999). On 2 August 2001, NMFS made available a review of the biological status of the Gulf of Maine/Bay of Fundy harbor porpoise population. The determination was made that listing under the Endangered Species Act (ESA) was not warranted, and this stock was removed from the ESA candidate species list (NMFS 2001).

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HARBOR SEAL (*Phoca vitulina concolor*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The harbor seal is found in all nearshore waters of the North Atlantic and North Pacific Oceans and adjoining seas above about 30ºN (Burns 2009; Desportes et al. 2010). In the western North Atlantic, they are distributed from the eastern Canadian Arctic and Greenland south to southern New England and New York, and occasionally to the Carolinas (Mansfield 1967; Boulva and McLaren 1979; Katona *et al.* 1993; Gilbert and Guldager 1998; Baird 2001;Desportes et al. 2010). Stanley *et al.* (1996) examined worldwide patterns in harbor seal mitochondrial DNA, which indicate that western and eastern North Atlantic harbor seal populations are highly differentiated. Further, they suggested that harbor seal females are only regionally philopatric, thus population or management units are on the scale of a few hundred kilometers. High philopatry has been reported in other North Atlantic populations (Goodman 1998; Andersen and Olsen 2010). Although the stock structure of the western North Atlantic population is unknown, it is thought that harbor seals found along the eastern U.S. and Canadian coasts represent one population (Temte *et al.* 1991; Andersen and Olsen 2010). In U.S. waters, breeding and pupping normally occur in waters north of the New Hampshire/Maine border, although breeding occurred as far south as Cape Cod in the early part of the twentieth century (Temte *et al.* 1991; Katona *et al.* 1993).

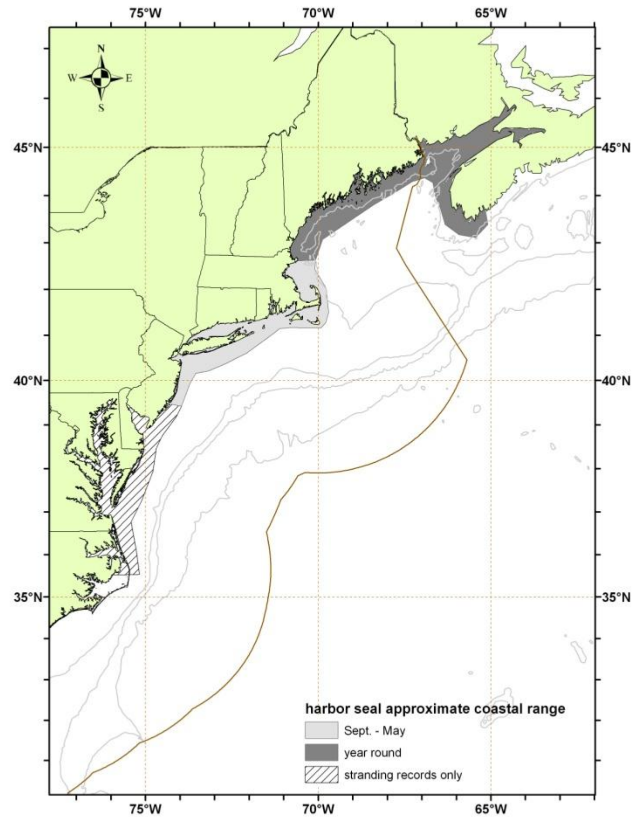

Figure 1. *Approximate coastal range of harbor seals. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.*

Harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine (Katona et al. 1993), and occur seasonally along the southern New England to New Jersey coasts from September through late May (Schneider and Payne 1983; Barlas 1999; Schroeder 2000; deHart 2002). In 2011 photographic evidence of a recently established seasonal haul out site at Oregon Inlet, North Carolina was reported (Todd Pusser, pers. comm. June 2011). Scattered sightings and strandings have been recorded as far south as Florida (NMFS unpublished data). A general southward movement from the Bay of Fundy to southern New England waters occurs in autumn and early winter (Rosenfeld *et al.* 1988; Whitman and Payne 1990; Barlas 1999; Jacobs and Terhune 2000). A northward movement from southern New England to Maine and eastern Canada occurs prior to the pupping season, which takes place from mid-May through June along the Maine Coast (Richardson 1976; Wilson 1978; Whitman and Payne 1990; Kenney 1994; deHart 2002). While earlier research identified no pupping areas in southern New England (Payne and Schneider 1984; Barlas 1999),); however, more recent anecdotal reports more recent information suggests that some pupping is occurring at high-use haulout sites off Manomet, Massachusetts. (B. Rubenstein, New England Aquarium, pers. comm.). The overall geographic range throughout coastal New England has not changed significantly during the last century (Payne and Selzer 1989).

Prior to the spring 2001 live-capture and radio-tagging of adult harbor seals, it was believed that the majority of seals moving into southern New England and mid-Atlantic waters were subadults and juveniles (Whitman and Payne 1990; Katona *et al.* 1993). The 2001 study established that adult animals also made this migration. Seventy-five percent (9/12) of the seals tagged in March in Chatham Harbor were detected at least once during the May/June 2001 abundance survey along the Maine coast (Gilbert *et al.* 2005; Waring *et al.* 2006).

POPULATION SIZE

Since passage of the MMPA in 1972, the observed count of seals along the New England coast has been increasing. Coast-wide aerial surveys along the Maine coast were conducted in May/June 1981, 1986, 1993, 1997, and 2001 during pupping (Gilbert and Stein 1981; Gilbert and Wynne 1983, 1984; Kenney 1994; Gilbert and Guldager 1998; Gilbert *et al.* 2005). However, estimates older than eight years are deemed unreliable (Wade and Angliss 1997), and should not be used for PBR determinations. Therefore, there is no current abundance estimate for harbor seals. The 2001 survey, conducted in May/June, included replicate surveys and radio tagged seals to obtain a correction factor for animals not hauled out. The corrected estimate (pups in parenthesis) for 2001 was 99,340 (23,722). The 2001 observed count of 38,014 is 28.7% greater than the 1997 count. Increased abundance of seals in the Northeast region has also been documented during aerial and boat surveys of overwintering haul-out sites from the Maine/New Hampshire border to eastern Long Island and New Jersey (Payne and Selzer 1989; Rough 1995; Barlas 1999; Schroeder 2000; deHart 2002).

Canadian scientists counted 3,500 harbor seals during an August 1992 aerial survey in the Bay of Fundy (Stobo and Fowler 1994), but noted that the survey was not designed to obtain a population estimate. The Sable Island population was the largest in eastern Canada in the late 1980s, however recently the number has drastically declined (Baird 2001). Similarly, pup production declined on Sable Island from 600 in 1989 to around a dozen pups or fewer by 2002 (Baird 2001; Bowen *et al.* 2003). A decline in the number of juveniles and adults did not occur immediately, but a decline was observed in these age classes as a result of the reduced number of pups recruiting into the older age classes (Bowen et al. 2003). Possible reasons for this decline may be increased use of the island by gray seals and increased predation by sharks (Stobo and Lucas 2000; Bowen *et al.* 2003). Helicopter surveys have also been flown to count hauled-out animals along the coast and around small islands in parts of the Gulf of St. Lawrence and the St. Lawrence estuary. In the estuary, surveys were flown in June 1995, 1996, and 1997, and in August 1994, 1995, 1996, and 1997; different portions of the Gulf were surveyed in June 1996 and 2001 (Robillard *et al.* 2005). Changes in counts over time in sectors that were flown under similar conditions were examined at nine sites that were surveyed in June and in August. Although all slopes were positive, only one was significant, indicating numbers are likely stable or increasing slowly. Overall, the June surveys resulted in an average of 469 (SD=60, N=3) hauled-out animals, which is lower than the average count of 621 (SD=41, N=3) hauled-out animals flown under similar conditions in August. Aerial surveys in the Gulf of St. Lawrence resulted in counts of 467 animals in 1996 and 423 animals in 2001 for a different area (Robillard et al. 2005).

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

A reliable estimate of the maximum net productivity rate is currently unavailable for this population. Based on uncorrected haul-out counts over the 1981 to 2001 survey period, the harbor seal population was growing at approximately 6.6% (Gilbert et al. 2005). However, a population grows at the maximum growth rate (R_{max}) only when it is at a very low level; thus the 6.6% growth rate is not considered to be a reliable estimate of R_{max}. For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate (½ of 12%), and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The recovery factor (F_R) for this stock is 0.5, the value for stocks of unknown status. PBR for the western North Atlantic stock of harbor seals is undetermined.

ANNUAL HUMAN-CAUSED MORTALITY

For the period 2006-2010~~2005-2009~~ the total human caused mortality and serious injury to harbor seals is estimated to be ~~385~~ 3~~53~~42 per year. The average was derived from two components: 1) ~~377~~ 3~~48~~37 (CV=0.~~13~~15; Table 2) from the ~~2005~~2006-~~2009~~ 2010 observed fishery; and 2) 5~~8~~ from average 2006-2010~~2005-2009~~ non-fishery-related, human interaction stranding mortalities (NMFS unpublished data).

Researchers and fishery observers have documented incidental mortality in several fisheries, particularly within the Gulf of Maine (see below). An unknown level of mortality also occurred in the mariculture industry (i.e., salmon farming), and by deliberate shooting (NMFS unpublished data). Between 2006~~2005~~ and 2010~~2009~~, there are ~~7~~ 5 records of harbor~~s~~ seals and ~~3~~ 2 of unidentified seals with evidence of gunshot wounds in the Northeast Regional Office Marine Mammal Stranding Network database.

Fishery Information

Detailed fishery information is given in Appendix III.

U.S.

Northeast Sink Gillnet:

Annual estimates of harbor seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. The fishery has been observed in the Gulf of Maine and in southern New England (Williams 1999; NMFS unpublished data). There were ~~581~~658 harbor seal mortalities observed in the Northeast sink gillnet fishery between 1990 and 2010~~2009~~, excluding three animals taken in the 1994 pinger experiment (NMFS unpublished data) but including one animal taken in a hanging ratio experiment (see below). Williams (1999) aged 261 harbor seals caught in this fishery from 1991 to 1997, and 93% were juveniles (i.e.. less than four years old). Estimated annual mortalities (CV in parentheses) from this fishery were 332 (0.33) in 1998, 1,446 (0.34) in 1999, 917 (0.43) in 2000, 1,471 (0.38) in 2001, 787 (0.32) in 2002, 542 (0.28) in 2003, 792 (0.34) in 2004, 719 (0.20) in 2005, 87 (0.58) in 2006, 92 in 2007, 243 (0.41) in 2008, ~~and~~ 516 (0.28) in 2009, and ~~567~~488 (0.25) in 2010 (Table 2). The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996). There were 2, 9, 14, 8, 14, 6, ~~and~~ 8, and 5 unidentified seals observed during 2003-2010~~2009~~, respectively. Since 1997, unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2006-2010~~2005-2009~~ was ~~301~~285~~332~~ harbor seals (CV=0.16~~0.14~~; Table 2).

~~Mid-Atlantic~~mid-Atlantic Gillnet

A study on the effects of two different hanging ratios in the bottom-set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010 with 100% observer coverage. Commercial fishing vessels from Massachusetts and New Jersey were used for the study, which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´) in February, March and April. Eight research strings of fourteen nets each were fished, and~~,~~ 159 hauls were completed during the course of the study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh~~,~~. T~~t~~here was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Four harbor seals (3 in mid-Atlantic gillnet and 1 in NE gillnet) were caught in this project during 2010 (Schnaittacher 2011).

No harbor seals were taken in observed trips during 1993-1997, or 1999-2003. Two harbor seals were observed taken in 1998, 1 in 2004, 2 in 2005, 1 in 2006, 0 in 2007, 2 in 2008, ~~and~~ 2 in 2009, and 6 in 2010. Using the observed and experimental takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 0 in 1995-1997 and 1999-2003, 11 in 1998 (0.77), 15 (0.86) in 2004, 63 (0.67) in 2005, 26 (0.98) in 2006, 0 in 2007, 88 (0.74) in 2008, ~~and~~ 47 (0.68) in 2009, and ~~75~~89 (0.41) in 2010. Average annual estimated fishery-related mortality attributable to this fishery during 2006-2010~~2005-2009~~ was ~~47~~50~~45~~ (CV =0.3~~5~~4~~0.39~~) harbor seals (Table 2).

Northeast Bottom Trawl

~~Seven~~Three harbor seal mortalities were observed ~~between 2001 and 2007, 1 in 2002, 1 in 2005, 3~~ in 2007, 0 in 2008, ~~and~~ 1 in 2009, and 0 in 2010. (Table 2). The estimated annual fishery-related mortality and serious injury attributable to this fishery has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2006-2010 is calculated as 0.8 animals (4 animals/5 years).

~~Mid-Atlantic~~mid-Atlantic Bottom Trawl

One harbor seal mortality was observed in this fishery in 2010. (Table 2). The estimated annual fishery-related mortality and serious injury attributable to this fishery has not been generated. . Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2006-2010 is calculated as 0.2 animals (1 animal/5 years).

Northeast Mid-water Trawl Fishery (Including Pair Trawl)

One harbor seal mortality was observed in this fishery in 2009 and 2 in 2010 (Table 2). The resultant estimated annual fishery-related mortality and serious injury (CV in parentheses) was ~~0~~1.3 in 2009 ~~.~~but an extended bycatch rate has not been calculated for 2010. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2006-2010 is calculated as 0.7 animals (2 animals +1.3 animals/5 years).

~~Mid-Atlantic~~mid-Atlantic Mid-water Trawl Fishery (Including Pair Trawl)

A harbor seal mortality was observed in this fishery in 2010.~~.~~ An expanded bycatch estimate has not been generated. . Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2006-2010 is calculated as 0.2 animals (1 animal/5 years).

Gulf of Maine Atlantic Herring Purse Seine Fishery

The Gulf of Maine Atlantic Herring Purse Seine Fishery is a Category III fishery. This fishery was not observed until 2003. No mortalities have been observed, but 11 harbor seals were captured and released alive in 2004 and 4 in 2005, 1 in 2008, and none in 2006 or 2009-2010. In addition, 5 seals of unknown species were captured and released alive in 2004, 2 in 2005, 1 in 2007, ~~1 in 2008~~ and none in 2009-2010. This fishery was not observed in 2006.

CANADA

Currently, scant data are available on bycatch in Atlantic Canada fisheries due to a lack of observer programs (Baird 2001). An unknown number of harbor seals have been taken in Newfoundland, Labrador, Gulf of St. Lawrence and Bay of Fundy groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, Atlantic Canada cod traps, and in Bay of Fundy herring weirs (Read 1994; Cairns *et al.* 2000). Furthermore, some of these mortalities (e.g., seals trapped in herring weirs) are the result of direct shooting.

Table 2. Summary of the incidental mortality of harbor seals (*Phoca vitulina concolor*) 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	Data Type [a]	Observer Coverage [b]	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality

Northeast Sink Gillnet[c]	~~05~~06-~~09~~10	Obs. Data, Weighout, Logbooks	~~.07,~~ .04, .07, .05, .04, .17	~~70,~~ 3, 6, 9, 21, 7~~2~~1	~~719,~~ 87, 93, 243, 516, ~~567~~488	~~.20,~~ .58, .49, .41, .28, .2~~8~~5	~~332~~~~301~~285(0.~~14.~~16)
~~Mid-Atlantic~~mid-Atlantic Gillnet	~~05~~06-~~09~~10	Obs. Data, Weighout	~~.03,~~ .04, .06, .03, .03, .04	~~2,~~ 1, 0, 2, 2, 9	~~63,~~ 26, 0, 88, 47, ~~75~~89	~~.67,~~ .98, 0, .74, .68, .41	~~45~~ ~~47~~50 (0.~~39.~~3~~5~~4)
Northeast Bottom Trawl	~~05~~06-~~09~~10	Obs. Data, Weighout	~~.12,~~ .06, .05, .08, .09, .16	~~1,~~ 0, 3, 0, 1, 0	~~unk[d],~~ 0, unk[d], 0, unk[d], unk[d],	~~unk[d],~~ 0, unk[d], 0, unk[d], unk[d],	~~unk[d]~~ 0.8 (na)[d]
~~Mid-Atlantic~~mid-Atlantic Bottom Trawl	06-10	Obs. Data Dealer	.02, .03, .03. .05, .06	0, 0, 0, 0 ,1	0, 0, 0, 0, na[d]	0, 0, 0, 0, na[d]	~~na~~0.2 (na)[d]
Northeast Mid-water Trawl - Including Pair Trawl	~~05~~06-~~09~~~~0~~10	Obs. Data Weighout Trip Logbook	~~.199,~~ .031, .08, .199, .42, .53	~~0,~~ 0, 0, 0, 1, 2	~~0,~~ 0, 0, 0, 1.3, na[d]	~~0,~~ 0, 0, 0, .81, na[d]	~~0.3 (0.81)~~~~na~~0.7[d]
~~Mid-Atlantic~~mid-Atlantic Mid-water Trawl - Including Pair Trawl	06-10	Obs. Data Weighout Trip Logbook	.089, .039, .13, .13, .25	0, 0, 0, 0, 1	0, 0, 0, 0, na[d]	0, 0, 0, 0, na[d]	~~na~~0.2 (na)[d]
TOTAL							~~377~~~~348~~337 (~~0.13~~0.15)

[a] Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. NEFSC collects landings data (Weighout), and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery.

[b] The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic gillnet fisheries are ratios based on tons of fish landed and coverages for the northeast bottom trawl are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP). In the Northeast region 437 and 658 bottom trawl trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 bottom trawl trips were sampled by observers and monitors, respectively.

[c] Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In ~~2005~~ 2006 - ~~2009~~2010, respectively, ~~3,~~ 3, 2, 0 ~~and,~~ 8 and 23 takes were observed in nets with pingers. In ~~2005~~ 2006 – ~~2009~~2010, respectively, ~~67,~~ 0, 4, 9 ~~and,~~ 13 and 48 takes were observed in nets without pingers.

[d] ~~Analysis~~ Analyses of bycatch mortality attributed to the Northeast or mid-Atlantic bottom trawl ~~fishery~~ fisheries for the years ~~2005~~2006-~~2009~~ 2010, or mid-water trawl fisheries for 2010 ~~has~~ have not been generated.

Other Mortality

Canada: Aquaculture operations in eastern Canada are licensed to shoot nuisance seals, but the number of seals killed is unknown (Jacobs and Terhune 2000; Baird 2001). Small numbers of harbor seals are taken in subsistence hunting in northern Canada, and Canada also issues personal hunting licenses which allow the holder to take six seals annually (DFO 2008).

U.S.: Historically, harbor seals were bounty-hunted in New England waters, which may have caused a severe decline of this stock in U.S. waters (Katona et al. 1993; Lelli *et al.*, 2009). Bounty-hunting ended in the mid-1960s.

Other sources of harbor seal mortality include human interactions, storms, abandonment by the mother, disease, and predation (Katona *et al.* 1993; NMFS unpublished data; Jacobs and Terhune 2000). Mortalities caused by human interactions include boat strikes, fishing gear interactions, oil spill/exposure, harassment, and shooting.

Small numbers of harbor seals strand each year throughout their migratory range. Stranding data provide insight into some of these sources of mortality. From 2006-2010, 1,405~~2005 to 2009, 1,477~~ harbor seal stranding mortalities were reported between Maine and Florida (Table 3; NMFS unpublished data). Sixty-five (4.6%) ~~Fifty nine (4%)~~ of the seals stranded during this five-year period showed signs of human interaction (~~14 in 2005,~~ 8 in 2006, 21 in 2007, 10 in 2008, ~~and~~ 6 in 2009, and 20 in 2010), with ~~18~~ 24 having some sign of fishery interaction (~~0 in 2005,~~ 8 in 2006, 5 in 2007, 5 in 2008, ~~and~~ 0 in 2009, and 6 in 2010). Five harbor seals during this period were reported as having been shot. An Unusual Mortality Event (UME) was declared for harbor seals in northern Gulf of Maine waters in 2003 and continued into 2004. No consistent cause of death could be determined. The UME was declared over in spring 2005 (MMC 2006). NMFS declared another UME in the Gulf of Maine in autumn 2006 based on infectious disease.

Stobo and Lucas (2000) have documented shark predation as an important source of natural mortality at Sable Island, Nova Scotia. They suggest that shark-inflicted mortality in pups, as a proportion of total production, was less than 10% in 1980-1993, approximately 25% in 1994-1995, and increased to 45% in 1996. Also, shark predation on adults was selective towards mature females. The decline in the Sable Island population appears to result from a combination of shark-inflicted mortality on both pups and adult females and inter-specific competition with the much more abundant gray seal for food resources (Stobo and Lucas 2000; Bowen *et al.* 2003).

Table 3. Harbor seal (*Phoca vitulina concolor*) stranding mortalities along the U.S. Atlantic coast (2006-2010) with subtotals of animals recorded as pups in parentheses[a].

State	2006[b]	2007[b]	2008	2009	2010	Total
ME	371 (220)	106 (80)	178 (152)	76 (64)	70 (64)	801
NH	28 (19)	6 (5)	3 (2)	15 (12)	20 (15)	72
MA	94 (35)	51 (17)	50 (4)	74 (36)	82 (26)	351
RI	6 (3)	8 (1)	6 (4)	5 (2)	4 (0)	29
CT	2 (1)	3	0	0	0	5
NY	11	11 (7)	5 (1)	14 (1)	15 (0)	56
NJ	7	6	7	11 (2)	21 (0)	52
DE	1	0	0	0	0	1
MD	0	0	0	2	0	2
VA	2	0	1	3	1 (0)	7
NC	4	0	6 (2)	6 (5)	11 (1)	27
SC	0	0	0	0	1	1
FL	1	0	0	0	0	1
Total	527	191	256	206	117	1405
Unspecified seals (all states)	46	34	51	34	22	187

a. Some of the data reported in this table differ from that reported in previous years. We have reviewed the records and made an effort to standardize reporting. Records of live releases and rehabbed animals have been eliminated. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.

b. Unusual Mortality Event (UME) declared for harbor seals in northern Gulf of Maine waters during 2006-2007.

Table 3. Harbor seal (*Phoca vitulina concolor*) stranding mortalities along the U.S. Atlantic coast (2005-2009) with subtotals of animals recorded as pups in parentheses[a].

State	2005	2006[b]	2007[b]	2008	2009	Total
ME	121(94)	371 (220)	106 (80)	178 (152)	76	852
NH	31 (25)	28 (19)	6 (5)	3 (2)	15	83
MA	101(45)	94 (35)	51 (17)	50 (4)	74	370
RI	3	6 (3)	8 (1)	6 (4)	5 (2)	28
CT	2 (1)	1 (1)	3	-	-	6
NY	22 (2)	11	11 (7)	5 (1)	14	63
NJ	1 (1)	7	6	7	11	32
DE	3 (1)	2	-	-	-	5
MD	2	-	-	-	2	4
VA	3	2	-	1	3	9
NC	8 (3)	4	-	6 (2)	6 (5)	24
FL	-	1	-	-	-	1
Total	297	527	191	256	206	1477
Unspecified seals (all states)	59	46	34	51	34	224

a. Some of the data reported in this table differ from those reported in previous years. We have reviewed the records and made an effort to standardize reporting. Records of live releases and rehabbed animals have been eliminated. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.

b. Unusual Mortality Event (UME) declared for harbor seals in northern Gulf of Maine waters during 2006-2007.

STATUS OF STOCK

Although PBR cannot be determined for this stock, the level of human-caused mortality and serious injury in the U.S. Atlantic EEZ is believed to be low relative to the total stock size; therefore, this is not a strategic stock. The status of the western North Atlantic harbor seal stock, 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. Total fishery-related mortality and serious injury for this stock is believed to be low relative to the population size in U.S. waters but cannot be considered to be approaching zero mortality and serious injury rate. Although PBR cannot be determined for this stock, the level of human-caused mortality and serious injury in the U.S. Atlantic EEZ is believed to be low relative to the total stock size; therefore, this is not a strategic stock.

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GRAY SEAL (*Halichoerus grypus grypus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The gray seal is found on both sides of the North Atlantic, with three major populations: eastern Canada, northwestern Europe and the Baltic Sea (Katona *et al.* 1993). The western North Atlantic stock is equivalent to the eastern Canada population, and ranges from New York to Labrador (Davies 1957; Mansfield 1966; Katona *et al.* 1993; Lesage and Hammill 2001). This stock is separated by geography, differences in the breeding season, and mitochondrial DNA variation from the northeastern Atlantic stock (Bonner 1981; Boskovic *et al.* 1996; Lesage and Hammill 2001). There are two breeding concentrations in eastern Canada; one at Sable Island, and one that breeds on the pack ice in the Gulf of St. Lawrence (Laviguer and Hammill 1993). Tagging studies indicate that there is little intermixing between the two breeding groups (Zwanenberg and Bowen 1990) and, for management purposes, they are treated by the Canadian DFO as separate stocks (Mohn and Bowen 1996). In the mid- 1980s, small numbers of animals and pupping were observed on several isolated islands along the Maine coast and in Nantucket-Vineyard Sound, Massachusetts (Katona *et al.* 1993; Rough 1995: Gilbert et al. 2005~~J. R. Gilbert, pers. comm., University of Maine, Orono, ME~~). In the late 1990s, a year-round breeding population of approximately 400+ animals was documented on outer Cape Cod and Muskeget Island (D. Murley, pers. comm., Mass. Audubon Society, Wellfleet, MA). In December 2001, NMFS initiated aerial surveys to monitor gray seal pup production on Muskeget Island and adjacent sites in Nantucket Sound, and Green and Seal Islands off the coast of Maine (Wood *et al.* 2007). To assess the stock structure of gray seals in the northwest Atlantic, tissue samples were collected from Canadian and US populations for genetic analyses (Wood et al. 2011). Based on examination of ~~–~~nine highly variable microsatellite loci, all individuals were placed into one population. This provides additional confirmation that recolonization by Canadian gray seals is the source of the U.S. population.

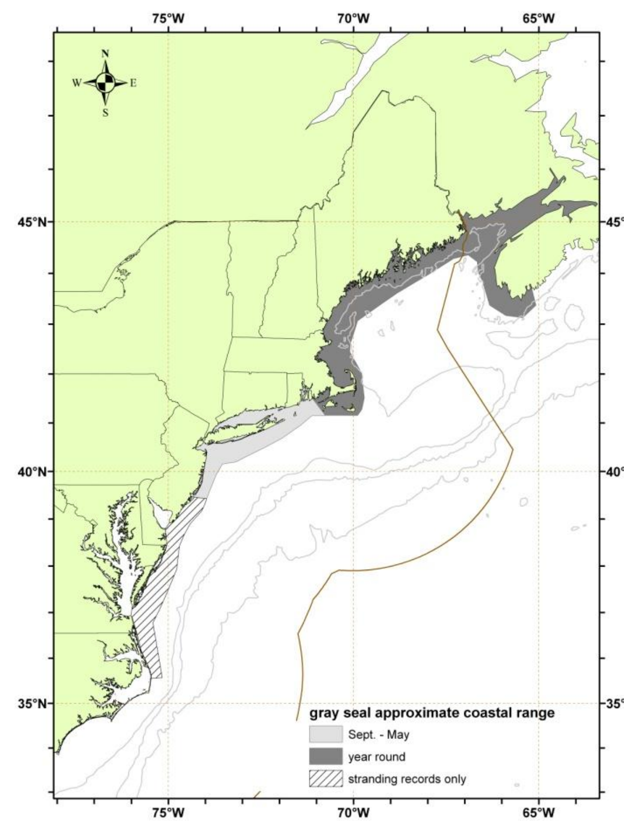

Figure 1. Approximate coastal range of gray seals. Isobaths are the 100-m, 1000-m, and 4000-m depth contours.

POPULATION SIZE

Current estimates of the total western Atlantic gray seal population are not available; although estimates of portions of the stock are available for select time periods. The size of the total Canadian population from 1977 ~~1993~~ to 2010~~2004~~ has been estimated by modeling gray seal population dynamics and available pup production data divided into three breeding regions: Sable Island, Gulf of St. Lawrence, and Coastal Nova Scotia (Thomas et al. 2011). The 2010 total population estimate was 348,900 (95% CI 291,300-414,900). This is 4% higher than the 2009 estimate (~~348,900~~335,200; 95% CI 292,300-395,100) (Thomas et al. 2011). Average annual rates of total population increase were estimated to be 6% in the 1980s, 9% in the 1990s, and 6% in the 2000s. The authors note that these estimates should be treated with caution due to modeling and data concerns. In comparison to the pooled estimates, Bowen et al. (2003) reported that the Sable Island had been increasing by approximately 13% for nearly 40 years, but subsequently declined to 7% based on the 2004 pup production survey (Trzcinski et al. 2005; Bowen et al. 2007). ~~from three surveys. A 1993 survey estimated the population at 144,000 animals (Mohn and Bowen 1996; DFO 2003) a 1997 survey estimated 195,000 (DFO 2003), and a 2004 survey obtained estimates ranging between 208,720 (SE=29,730) and 223,220 (SE=17,376) depending upon the model used (Trzcinski *et al.* 2005). The population at Sable Island had been increasing by approximately 13% per year for nearly 40 years (Bowen *et al.* 2003), but the most recent (2004) survey results indicated that this rate of population increase had declined to 7% (Trzcinski *et al.* 2005; Bowen *et al.* 2007). The non-Sable Island (Gulf of St Lawrence and Eastern Shore) abundance has increased from 20,900 (SE=200) in 1970 to 52,500 (SE=7,800) in 2004 (Hammill 2005).~~

In U.S. waters, gray seals currently pup at three established colonies: Muskeget Island, Massachusetts, Green Island, Maine, and Seal Island, Maine, as well as, more recently, at Matinicus Rock in Maine. Although white coated pups have stranded on eastern Long Island beaches, no pupping colonies have been detected in that region. ~~They~~ Gray seals have been observed using the historic pupping site on Muskeget Island in Massachusetts since 1990. Pupping has taken place on Seal and Green Islands in Maine since at least the mid 1990~~'~~s. Aerial survey data from these sites indicate that pup production is increasing. A minimum of 2,620 pups (Muskeget= 2,095, Green= 59, Seal= 466) ~~was~~ were born in the U.S. in 2008 (Wood LaFond 2009). Table 2 summarizes single-day pup counts from the three U.S. pupping colonies from 2001/2002 to 2007/2008 pupping periods. The decrease in pup counts in some years is an artifact of survey timing and not indicative of true declines in those years. In recent years NMFS monitoring surveys have detected an occasional mother/pup (white coats) pair on both Monomoy Island and Noman's Land in Massachusetts. Some of the local breeders have been observed with brands and tags indicating they had been born on Sable Island, Canada (Rough 1995; L. Sette, pers. comm., Provincetown Center for Coastal Studies). The increase in the number of gray seals observed in the U.S. is probably due to both natural increase and immigration.

Gray seals are also observed in New England outside of the pupping season. In April-May 1994 a maximum count of 2,010 was obtained for Muskeget Island and Monomoy combined (Rough 1995). Maine coast-wide surveys conducted during summer revealed 597 and 1,731 gray seals in 1993 and 2001, respectively (Gilbert *et al.* 2005). In March 1999 a maximum count of 5,611 was obtained in the region south of Maine (between Isles of Shoals, Maine and Woods Hole, Massachusetts) (Barlas 1999). In March 2011 a maximum count of 15,756 was obtained in southeastern Massachusetts coastal waters (NMFS unpubl. data). No gray seals were recorded at haul-out sites between Newport, Rhode Island and Montauk Pt., New York (Barlas 1999), although, more recently several hundred gray seals have been recorded in surveys conducted off eastern Long Island (R. DiGiovanni, pers. comm., The Riverhead Foundation for Research and Preservation, Riverhead, NY).

Table 1. Summary of abundance estimates for the western North Atlantic gray seal: ~~month,~~ year, and area covered during each abundance survey, resulting total abundance estimate ~~(N_{best})~~ and 95% confidence interval. ~~coefficient of variation (CV).~~

Month/Year	Area	Nbest	CI~~CV~~
2010	Gulf of St Lawrence + Nova Scotia Eastern Shore + Sable Island	348,900	95% CI 291,300-414,900
~~January 2004[a]~~	~~Gulf of St Lawrence + Nova Scotia Eastern Shore~~	~~52,500~~	~~0.15~~
~~January 2004[a]~~	~~Sable Island~~	~~208,720~~ ~~216,490~~ ~~223,220~~	~~0.14~~ ~~0.11~~ ~~0.08~~

[a]These are model based estimates derived from pup surveys.

Table 2. The number of pups observed on Muskeget, Seal, and Green Islands 2002-2008. Data are from aerial surveys. These are single-day counts, not estimates of total pup production. (Wood LaFond 2009).

Pupping Season	Muskeget Island	Seal Island	Green Island
2001-2	883	No data	34
2002-3	509	147	No data

2003-4	824	150	26
2004-5	992	365	33
2005-6	868	239	43
2006-7	1704	364	57
2007-8	2095	466	59

Minimum Population Estimate

Based on modeling, ~~Depending on the model used, the N_{min} for~~ the total Canadian gray seal population was estimated to be 348,999 (95% CI 291,300-414,900) (Thomas et al. 2011).~~range between 125,541 and 169,064 (Trzcinski et al. 2005)~~ Present data are insufficient to calculate the minimum population estimate for U.S. waters.

Current Population Trend

Gray seal abundance is likely increasing in the U.S. Atlantic Exclusive Economic Zone (EEZ), but the rate of increase is unknown. The population in eastern Canada was greatly reduced by hunting and bounty programs, and in the 1950s the gray seal was considered rare (Lesage and Hammill 2001). The Sable Island population was less affected and has been increasing for several decades. Pup production on Sable Island, Nova Scotia, ~~has~~ increased exponentially at a rate of 12.8% per year between the 1970s and 1997 ~~annually for more than 40 years~~ (Stobo and Zwanenburg 1990; Mohn and Bowen 1996; Bowen *et al.* 2003; Trzcinski *et al.* 2005; Bowen *et al.* 2007;DFO 2011a), but has declined to about 4% per year between 2007 and 2010 (DFO 2011a).~~7% in 2004 (Trzcinski *et al.* 2005; Bowen *et al.* 2007).~~ The non Sable Island population increased from approximately 25,000 in ~~6,900 in~~ the mid-1980s to a peak of 71,500 ~~11,100 (SE=1,300) animals in 1996 (Hammill and Gosselin 2005)~~in 2010 (Thomas et al. 2011). Modeling estimates of ~~P~~pup production increased from approximately 6,000 ~~declined to 6,100 (SE=900)~~ in 1985~~2000, then increased~~ to 17,400 in 2010 (Thomas et al. 2011).~~15,900 (SE=1,200) in 2004 (Hammill and Gosselin 2005).~~ Approximately 70% ~~57%~~ of the western North Atlantic population is from the Sable Island stock. In recent years pupping has been established on Hay Island, off the Cape Breton coast (Lesage and Hammill 2001).

Surveys of winter breeding colonies in Maine and on Muskeget Island may provide some measure of gray seal population trends and expansion in distribution. Sightings in New England increased during the 1980's as the gray seal population and range expanded in eastern Canada. Five pups were born at Muskeget in 1988. The number of pups increased to 12 in 1992, 30 in 1993, and 59 in 1994 (Rough 1995). In January 2002, 883 pups were counted on Muskeget Island and surrounding shoals (Wood Lafond 2009). In recent years NMFS monitoring surveys have detected an occasional mother/pup (white coats) pair on both Monomoy Island and Nomans Land. These observations continue the increasing trend in pup production reported by Rough (1995). ~~The change in gray seal counts at Muskeget and Monomoy from 2,010 in spring 1994 to 5,611 in spring 1999 represents an annual increase rate of 20.5%, however, it has not been determined what proportion of the increase represents growth or immigration.~~ The change in gray seal counts from southeastern Massachusetts (i.e., Monomoy, Muskeget and adjacent tidal bars) from 5,611 in spring 1999 to 15,756 in spring 2011 represents an annual increase of 8.6%, however, it has not been determined what proportion of the increase represents growth or immigration. For example, a few gray seals branded as pups on Sable Island in the 1970s and 2000s (Stobo and Zwanenburg 1990; C. denHeyer, pers. comm.. DFO, Halifax), and satellite tagged adults have been ~~are typically~~ sighted in the Cape Cod region~~. during winter~~ .

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. ~~A recent~~ Recent studies~~y~~ estimated the current annual rate of increase at 7% on Sable Island (Trzcinski *et al.* 2005; Bowen *et al.* 2007), which represents a 45% decline from previous estimates (Mohn and Bowen 1996; Bowen *et al.* 2003). For purposes of this assessment, the maximum net productivity rate was assumed to be 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~“recovery”~~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 0.12, the default value for pinnipeds. The recovery factor (F_R) for this stock is 1.0, the value for stocks of unknown status, but which are known to be increasing. PBR for the western North Atlantic gray seals in U.S. waters is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period 2006-2010~~2005-2009~~, the total estimated human caused mortality and serious injury to gray seals was ~~5,2821~~5,250~~,682~~ per year. The average was derived from five~~three~~ components: 1) ~~882~~850~~678~~ (Table 3) from the 2006-2010~~2005-2009~~ U.S. observed fishery; 2) ~~xx~~6~~5~~ from average 2006-2010~~2005-2009~~ non-fishery related, human interaction stranding mortalities (NMFS unpublished data); ~~and~~ 3) 1,079 ~~999~~ from average 2006-2010~~2005-2009~~ kill in the Canadian hunt; 4) 23 from DFO scientific collections; and 5) 3,292 removals of nuisance animals in Canada.

Fishery Information

Detailed fishery information is given in Appendix III.

U.S.

Northeast Sink Gillnet

Annual estimates of gray seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. There were 375~~268~~ gray seal mortalities observed in the Northeast sink gillnet fishery between 1993 and 2010~~2009~~. Estimated annual mortalities (CV in parentheses) from this fishery were 0 in 1990-1992, 18 in 1993 (1.00), 19 in 1994 (0.95), 117 in 1995 (0.42), 49 in 1996 (0.49), 131 in 1997 (0.50), 61 in 1998 (0.98), 155 in 1999 (0.51), 193 in 2000 (0.55), 117 in 2001 (0.59), 0 in 2002, 242 (0.47) in 2003, 504 (0.34) in 2004, 574 (0.44) in 2005, 314 (0.22) in 2006, 886 (0.24) in 2007, 618 (0.23) in 2008, ~~and~~ 1,063 in 2009, and 107 in 2010 (Table 3). There were 2, 9, 14, 8, 14, 6, ~~and~~ 8 and 7~~–~~ unidentified seals observed during 2003-2010~~2009~~, respectively. Since 1997 unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2006-2010~~2005-2009~~ was ~~829~~791~~678~~ gray seals (CV=0.14) (Table 3). The stratification design used is the same as that for harbor porpoise (Bravington and Bisack 1996).

~~Mid-Atlantic~~mid-Atlantic Gillnet

~~2010 was the first year that g~~Gray seal interactions ~~have been~~were observed in this fishery in 2010, when~~.~~ ~~9~~nine gray seal and 2 unidentified seal mortalities were observed. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2010 was 53 (CV=0.76).

~~Mid-Atlantic~~mid-Atlantic Mid-Water Trawl

One gray seal mortality was observed in 2010 in this fishery. An expanded bycatch estimate has not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2006-2010 is calculated as 0.2 animal (1 animal /5 years).

Gulf of Maine Atlantic Herring Purse Seine Fishery

The Gulf of Maine Atlantic Herring Purse Seine Fishery is a Category III fishery. This fishery was not observed until 2003, and was not observed in 2006. No mortalities have been observed, but 15 gray seals were captured and released alive in 2004, 19 in 2005, 0 in 2007, 6 in 2008, ~~and~~ 0 in 2009, and 4 in 2010. In addition, 5 seals of unknown species were captured and released alive in 2004, 2 in 2005, 1 in 2007~~,~~ and none in 2008-~~2009~~–2010.

Northeast Bottom Trawl

Vessels in the North Atlantic bottom trawl fishery, a Category III fishery under MMPA, were observed in order to meet fishery management, rather than marine mammal management needs. No mortalities were observed prior to 2005, when four mortalities were attributed to this fishery. No mortalities were observed in 2006. The estimated annual fishery-related mortality and serious injury attributable to this fishery was 0 between 2001 and 2004, and for 2006. Nine gray seal mortalities were attributed to this fishery in 2007, 4 in 2008, ~~and~~ 8 in 2009, and 9 in 2010. Estimates have not been generated. Until this bycatch estimate can be developed, the average annual fishery-related mortality and serious injury for 2006-2010 is calculated as 6 animals (30 animals /5 years).

CANADA

An unknown number of gray seals have been taken in Newfoundland and Labrador, Gulf of St. Lawrence, and Bay of Fundy groundfish gillnets, Atlantic Canada and Greenland salmon gillnets, Atlantic Canada cod traps, and in Bay of Fundy herring weirs (Read 1994). In addition to incidental catches, some mortalities (e.g., seals trapped in herring weirs) were the result of direct shooting, and there were culls of about 1,700 animals annually during the 1970s and early 1980s on Sable Island (Anonymous 1986).

In 1996, observers recorded 3 gray seals (1 released alive) in Spanish deep-water trawl fishing on the southern edge of the Grand Banks (NAFO Areas 3) (Lens 1997). Seal bycatch occurred year-round, but interactions were highest during April-June. Many of the seals that died during fishing activities were unidentified. The proportion of sets with mortality (all seals) was 2.7 per 1,000 hauls (0.003).

Table 3. Summary of the incidental mortality of gray seal (*Halichoerus grypus grypus*) by commercial fishery including the years sampled (Years), 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	Data Type[a]	Observer Coverage[b]	Observed Mortality	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet[c]	~~05~~06-~~09~~10	Obs. Data, Weighout, Logbooks	~~.07,~~ .04, .07, .05. 04, .17	~~33,~~ 9, 80, 31, 52, 107	~~574,~~ 248, 886, 618, 1063, ~~1329~~1142	~~.44,~~ .47, .24, .23, .26, .32	~~678~~ ~~829~~791 (0.14)
~~Mid-Atlantic~~mid-Atlantic Gillnet	06-10	Obs. Data, Trip Logbook, Allocated Dealer Data	.03, .04, .03, .03, .04	0, 0, 0, 0, 9	0, 0, 0, 0, 267	0, 0, 0, 0, .76	53 (.76)
Northeast Bottom Trawl	~~05~~06-~~09~~10	Obs. Data, Weighout	~~.12,~~ .06, .06, .08, .09, .16	~~4,~~ 0, 9, 4, 8, 9	~~unk[d] ,~~ 0, unk[d], unk[d], unk[d], unk[d]	~~unk[d] ,~~ 0, unk[d,] unk[d], unk[d], unk[d]	~~unk[d]~~ 6 (na)[d]
~~Mid-Atlantic~~mid-Atlantic Mid-water Trawl - Including Pair Trawl	06-10	Obs. Data Weighout Trip Logbook	.089, .039, .13, .13, .25	0, 0, 0, 0, 1	0, 0, 0, 0,na	0, 0, 0, 0, unk[d]	0.2 (na)[d]
TOTAL							~~678~~~~882~~850 (0.14)

a. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. The Northeast Fisheries Observer Program collects landings data (Weighout), and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast multispecies sink gillnet fishery.

b. The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic gillnet fisheries are ratios based on tons of fish landed. North Atlantic bottom trawl mid-Atlantic bottom trawl, and mid-Atlantic mid-water trawl fishery coverages are ratios based on trips. Total observer coverage reported for bottom trawl gear and gillnet gear in the year 2010 includes samples collected from traditional fisheries observers in addition to fishery monitors through the Northeast Fisheries Observer Program (NEFOP). In the Northeast region 437 and 658 bottom trawl trips were sampled by observers and monitors, respectively. In the mid-Atlantic region, 661 and 75 bottom trawl trips were sampled by observers and monitors, respectively.

c. Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 20052006- 20092010, respectively, 1, 1, 8, 4and 4, 13, and 17 takes were observed in nets with pingers. In 2005 2006 – -20092010, respectively, 20, 32, 8, 72, 27, and 39, and 90 takes were observed in nets without pingers.

d. Analysis of bycatch mortality attributed to the Northeast bottom trawl fishery and midwater trawl fishery has not been generated. Unexpanded values are provisionally provided.

Other Mortality

Canada: In Canada, gray seals were hunted for several centuries by indigenous people and European settlers in the Gulf of St. Lawrence and along the Nova Scotia eastern shore, and were locally extirpated (Laviguer and Hammill 1993). Between 1999 and 20102009 the annual kill of gray seals by hunters in Canada was: 1999 (98), 2000 (342), 2001 (76), 2002 (126), 2003 (6), 2004 (0), 2005 (1073)(579), 2006 (1,85704) 2007 (1747)(887), 2008 (1,4721), and 2009 (26354), and 2010 (58). (DFO 2003; 2008; 2009; 2011b M. Hammill pers. comm.). The traditional hunt of a few hundred animals is expected to continue off the Magdalen Islands and in other areas, except Sable Island where commercial hunting is not permitted (DFO 2003). DFO established a total allowable catch (TAC) of 12,000 gray seals for 2007 and 2008: 2,000 in the Gulf and 10,000 on the Scotian Shelf. The TAC for 2009 and 2010 was 50,000 seals. Since 2007, a small commercial hunt has taken place on Hay Island in Nova Scotia (http://www.dfo-mpo.gc.ca/fm-gp/seal-phoque/faq-eng.htm). The Hay Island TAC for 2010 was 2,220 (DFO 2011cb). The hunting of gray seals will continue to be prohibited on Sable Island (http://www.dfo-mpo.gc.ca/seal-phoque/index_e.htm).

Canada also issues personal hunting licenses which allow the holder to take six gray seals annually (Lesage and Hammill 2001; DFO 2011b). Hunting is not permitted during the breeding season and some additional seasonal/spatial restrictions are in effect (Lesage and Hammill 2001). Further, between 2005 and 2010 the lethal removal of nuisance seals was: 2005 (3105), 2006 (3437), 2007 (3373), 2008 (3334), 2009 (3381, and 2010 (2933) (DFO 2011b).

U.S: Gray seals, like harbor seals, were hunted for bounty in New England waters until the late 1960s (Katona, *et al.* 1993; Lelli, *et al*. 2009). This hunt may have severely depleted this stock in U.S. waters (Rough 1995; Lelli, *et al*. 2009). Other sources of mortality include human interactions, storms, abandonment by the mother, disease, and predation. Mortalities caused by human interactions include boat strikes, fishing gear interactions, power plant entrainment, oil spill/exposure, harassment, and shooting. The Cape Cod stranding network has documented gray seals entangled in netting or plastic debris around the Cape Cod/Nantucket area, and in recent years have made successful disentanglement attempts.

From 2006 to 2010,2005 to 2009,375 224 gray seal stranding mortalities were recorded, extending from Maine to North Carolina (Table 4; NMFS unpublished data). Most stranding mortalities were in Massachusetts, which is the center of gray seal abundance in U.S. waters. Fifty-one (22.8%) Sixty (16.0%) of the total stranding mortalities showed signs of human interaction (3 in 2005, 5 in 2006, 8 in 2007, 21 in 2008, and 14 in 2009, and 12 in 2010), with 3027 having some indication of fishery interaction (1 in 2005, 5 in 2006, 5 in 2007, 7 in 2008, and 9 in 2009, and 4 in 2010). Four gray seals are recorded in the NE stranding database during the 2006 to 2010 period as having been shot –one in Maine in 2009 and one in Maine and two in Massachusetts in 2010.

Table 4. Gray seal (*Halichoerus grypus grypus*) stranding mortalities [a] along the U.S. Atlantic coast (2006-2010) with subtotals of animals recorded as pups in parentheses.

State	2006	2007	2008	2009	2010	Total
ME	3	5 (1)	6 (1)	3	8 (4)	25
NH	0	1 (1)	0	1 (1)	0	2
MA	29 (5)	50 (9)	53 (4)	52 (7)	43 (5)	227
RI	2 (2)	5 (1)	7	10 (2)	8 (3)	32
CT	0	0	0	1(1)	0	1

NY	6 (4)	21 (17)	2 (2)	16 (7)	10 (7)	55
NJ	1 (1)	5 (2)	3	4	4 (1)	17
DE	0	0	1 (1)	0	0	1
MD	0	1	1	1	1	4
VA	0	1	1	2	1	5
NC	2	1 (1)	1 (1)	1 (1)	1	6
Total	43 (12)	90 (32)	75 (9)	91 (19)	76 (20)	375
Unspecified seals (all states)	46	34	51	34	22	187
a. Mortalities include those which stranded dead, died at site, were euthanized, died during transport, or died soon after transfer to rehab.						

Table 4. Gray seal (*Halichoerus grypus grypus*) stranding mortalities[a] along the U.S. Atlantic coast (2005-2009) with subtotals of animals recorded as pups in parentheses.

State	2005	2006	2007	2008	2009	Total
ME	4 (1)	3	5 (1)	6 (1)	3	21
NH	-	-	1 (1)	-	1 (1)	2
MA	26 (6)	29 (5)	50 (9)	53 (4)	52 (7)	210
RI	2 (1)	2 (2)	5 (1)	7	10 (2)	26
CT	-	-	-	-	1(1)	1
NY	7	6 (4)	21 (17)	2 (2)	16 (7)	52
NJ	2 (2)	1 (1)	5 (2)	3	4	15
DE	-	-		1 (1)	-	1
MD	3 (2)	-	1	1	1	6
VA	1	-	1	1	2	5
NC	-	2	1 (1)	1 (1)	1 (1)	5
Total	45 (12)	43 (12)	90 (32)	75 (9)	91 (19)	344 (84)
Unspecified seals (all states)	59	46	34	51	34	224
a. Mortalities include those which stranded dead, died at site, were euthanized, died during transport, or died soon after transfer to rehab.						

STATUS OF STOCK

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

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HARP SEAL (*Pagophilus groenlandicus*): Western North Atlantic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The harp seal occurs throughout much of the North Atlantic and Arctic Oceans (Ronald and Healey 1981; Lavigne and Kovacs 1988). The world's harp seal population is divided into three separate stocks, each identified with a specific pupping site on the pack ice (Lavigne and Kovacs 1988; Bonner 1990). The largest stock is located off eastern Canada and is divided into two breeding herds. The Front herd breeds off the coast of Newfoundland and Labrador, and the Gulf herd breeds near the Magdalen Islands in the middle of the Gulf of St. Lawrence (Sergeant 1965; Lavigne and Kovacs 1988). The second stock breeds on the West Ice off eastern Greenland (Lavigne and Kovacs 1988), and the third stock breeds on the ice in the White Sea off the coast of Russia. The Front/Gulf stock is equivalent to western North Atlantic stock.

Harp seals are highly migratory (Sergeant 1965; Stenson and Sjare 1997). Breeding occurs at different times for each stock between late-February and April. Adults then assemble on suitable pack ice to undergo the annual molt. The migration then continues north to Arctic summer feeding grounds. In late September, after a summer of feeding, nearly all adults and some of the immature animals of the western North Atlantic stock migrate southward along the Labrador coast, usually reaching the entrance to the Gulf of St. Lawrence by early winter. There they split into two groups, one moving into the Gulf and the other remaining off the coast of Newfoundland. The southern limit of the harp seal's habitat extends into the U.S. Atlantic Exclusive Economic Zone (EEZ) during winter and spring.

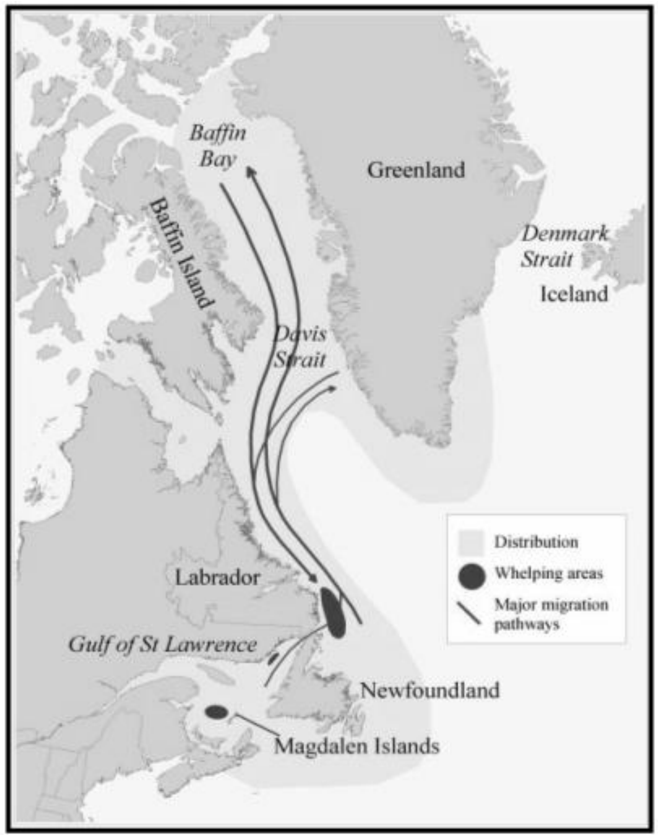

Figure 1: From: *Technical Briefing on the Harp Seal Hunt in Atlantic Canada* http://www.dfo-mpo.gc.ca/misc/seal_briefing_e.htm

Since the early 1990s, numbers of sightings and strandings have been increasing off the east coast of the United States from Maine to New Jersey (Katona *et al.* 1993; Rubinstein 1994; Stevick and Fernald 1998; McAlpine 1999; Lacoste and Stenson 2000). These extralimital appearances usually occur in January-May (Harris *et al.* 2002), when the western North Atlantic stock of harp seals is at its most southern point of migration. Concomitantly, a southward shift in winter distribution off Newfoundland was observed during the mid-1990s, which was attributed to abnormal environmental conditions (Lacoste and Stenson 2000).

POPULATION SIZE

Abundance estimates for the western North Atlantic stock are available which use a variety of methods including aerial surveys and mark-recapture (Table 1). These methods involve surveying the whelping concentrations and estimating total population adult numbers from pup production. Roff and Bowen (1983) developed an estimation model to provide a more precise estimate of total abundance. This technique incorporates recent pregnancy rates and estimates of age-specific hunting mortality (CAFSAC 1992). This model has subsequently been updated in Shelton *et al.* (1992), Stenson (1993), Shelton *et al.* (1996), and Warren *et al.* (1997).

The revised 2000 population estimate was 5.5 million (95% CI= 4.5-6.4 million) harp seals. (Healey and Stenson 2000). The estimate based on the 2004 survey was calculated at 5.82 million (95% CI=4.1-7.6 million; Hammill and Stenson 2005) but has been subsequently revised to 5.5 million (95% CI=3.8 - 7.1 million; Table 1; DFO 2007). The 2008 and 2009 estimates, respectively, based on the 2008 survey of the Gulf and Front were 6.5 million (95% CI=5.7 to 7.3 million) and 6.9 million (95% CI=6.0 to 7.7 million; Table 1; DFO 2010). A revised model assuming density-dependent population growth, carrying capacity of 12 million and annual reproductive rate data was fitted to the 2008 survey data (DFO 2011 in review). The model -estimated a total population 8.3 million (95% CI=7.5-8.9 million animals) increasing to 8.6 – 9.6 million (95% CI=7.8 to 10.8 million) animals in 2010.

Table 1. Summary of abundance estimates for western North Atlantic harp seals in Canadian waters. Year and area covered during each abundance survey, resulting abundance estimate (N_{best}) and confidence interval (CI).

Month/Year	Area	N_{best}	CI
2004	Front and Gulf	5.5 million	(95% CI 3.8-7.1 million)
2008	Front and Gulf	~~6.5 million~~ 8.3 million	~~(95% CI 5.7-7.3 million)~~ (95% CI 7.5-8.9 million)
2010~~2009~~	Front and Gulf	~~6.9 million~~ 8.6-9.6 million	~~(95% CI 6.0-7.7 million)~~ (95% CI 7.8-10.8 million)

Minimum population estimate

The minimum population estimate is the lower limit of the two-tailed 60% confidence interval of the log-normally distributed best abundance estimate. This is equivalent to the 20th percentile of the log-normal distribution as specified by (Wade and Angliss 1997). The best estimate of abundance for western North Atlantic harp seals is ~~6.9~~ 8.3 million (95% CI 7.5-8.9~~6.0-7.7~~ million; DFO 201~~0~~1 in review)~~, in review~~. ~~The minimum population estimate based on the 2008 pup survey results is 6.5 million (CV=0.06) seals.~~ Data are insufficient to calculate the minimum population estimate for U.S. waters.

Current population trend

Harp seal pup production in the 1950s was estimated at 645,000, but had decreased to 225,000 by 1970 (Sergeant 1975). Estimated number then began to increase and have continued to increase through the late 1990s, reaching 478,000 in 1979 (Bowen and Sergeant 1983; 1985), 577,900 (CV=0.07) in 1990 (Stenson *et al.* 1993), 708,400 (CV=0.10) in 1994 (Stenson *et al.* 2002), and 998,000 (CV=0.10) in 1999 (Stenson *et al.* 2003). The 2004 estimate of 991,000 pups (CV=0.06) was not significantly different from the 1999 estimate, which suggested that the increase in pup production observed throughout the 1990s may have abated (Stenson *et al.* 2005). ~~The~~ However, the 2008 revised estimate of pup production is 1,630,300 (CV=6.8%) ~~d of 1,076,600 pups (CV=0.06) is~~, based on photographic and ~~the~~ visual aerial survey counts (DFO 2011, in review), and indicates that pup production had increased in intervening years since 1999.~~(DFO 2010).~~

The population appears to be increasing in U.S. waters, judging from the increased number of stranded harp seals, but the magnitude of the suspected increase is unknown

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 0.12. This value is based on theoretical modeling showing that pinniped populations may not grow at rates much greater than 12% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size in U.S. waters is unknown. The maximum productivity rate is 0.12, the default value for pinnipeds. The ~~“recovery”~~recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP) was set at 1.0 the population is increasing. PBR for the western North Atlantic harp seal in U.S. waters is unknown. ~~Applying the formula to the minimum population estimate for Canadian waters results in a "PBR" of 289,220 harp seals. However, t~~The PBR for the stock in US waters is unknown.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

For the period 2006-2010~~2005-2009~~ the total estimated annual human caused mortality and serious injury to harp seals was 379,~~769~~673 ~~441,950~~. This is derived from three ~~two~~ components: 1) an average catch of 379,387 ~~441,719~~ seals from 2006-2010~~2005-2009~~ by Canada and Greenland, including bycatch in the lumpfish fishery (Table 2a);~~ and~~ 2) ~~378~~282 ~~231~~ harp seals (CV=0.~~35~~19~~0.18~~) from the observed U.S. fisheries (Table 2b); and 3) an average of 4 stranded seals from 2006-2010 that showed signs of non fishing human interaction. ~~(Table 2b).~~

Table 2a. Summary of the Canadian directed catch and bycatch incidental mortality of harp seal (*Pagophilus groenlandicus*) by year

Fishery	**2006**	**2007**	**2008**	**2009**	**2010**	**Average**
Commercial catches[a]	354,867	224,745	217,85~~0~~	76,66~~8~~	69,101	**188,646**
Commercial catch struck and lost[b]	26,674	14,914	11,736	4,035	4,060	**12,284**
Greenland subsistence catch[c]	92,210	82,836	80,556	71,046	83,669	**82,063**
Canadian Arctic[d]	1,000	1,000	1,000	1,000	1,000	**1,000**
Greenland and Canadian Arctic struck and lost[e]	93,210	83,836	81,556	72,046	84,669	**83,063**
Newfoundland lumpfish[f]	12,330	12,330	12,330	12,330	12,330	**12,330**
Total	**580,291**	**419,661**	**405,028**	**237,125**	**254,829**	**379,387**

a. Hammill and Stenson 2003, DFO 2003, DFO 2005, DFO 2010; ICES 2011; Stenson unpublished data

b. Struck and lost is calculated for the commercial harvest assuming that the rate is 5% for young of the year, and 50% for animals one year of age and older (DFO 2001, Stenson unpublished data).

c. ICES 2003, 2011 DFO 2005, 2010; Stenson unpublished data

d. Hammill and Stenson 2003; Stenson unpublished data;

e. The Canadian Arctic and Greenland struck and lost rate is calculated assuming the rate is 50% for all age classes (DFO 2001; Stenson unpublished data).

f. DFO 2005; Stenson unpublished data; 2001-2004 average used.

~~Table 2a. Summary of the Canadian directed catch and bycatch incidental mortality of harp seal (*Pagophilus groenlandicus*) by year.~~

~~**Fishery**~~	~~**2005**~~	~~**2006**~~	~~**2007**~~	~~**2008**~~	~~**2009**~~	~~**Average**~~
~~Commercial catches[a]~~	~~323,826~~	~~354,867~~	~~224,745~~	~~217,850~~	~~76,668~~	~~**239,591**~~
~~Commercial catch struck and lost[b]~~	~~21,495~~	~~26,674~~	~~14,914~~	~~11,724~~	~~4,035~~	~~**15,768**~~
~~Greenland subsistence catch[c]~~	~~91,696~~	~~92,210~~	~~82,778~~	~~82,843~~	~~82,843~~	~~**86,474**~~
~~Canadian Arctic[d]~~	~~1,000~~	~~1,000~~	~~1,000~~	~~1,000~~	~~1,000~~	~~**1,000**~~
~~Greenland and Canadian Arctic struck and lost[e]~~	~~92,696~~	~~93,210~~	~~83,778~~	~~81,648~~	~~83,843~~	~~**87,035**~~
~~Newfoundland lumpfish[f]~~	~~12,290~~	~~12,290~~	~~12,290~~	~~12,290~~	~~12,290~~	~~**12,290**~~
~~**Total**~~	~~**543,002**~~	~~**580,251**~~	~~**419,505**~~	~~**405,160**~~	~~**260,679**~~	~~**441,719**~~

~~a. Hammill and Stenson 2003, DFO 2003, DFO 2005, DFO 2010; Stenson unpublished data~~
~~b. Struck and lost is calculated for the commercial harvest assuming that the rate is 5% for young of the year, and 50% for animals one year of age and older (DFO 2001, Stenson unpublished data).~~
~~c. ICES 2003, DFO 2005, 2010; Stenson unpublished data; 2002-2004 average used for 2005~~
~~d. Hammill and Stenson 2003; Stenson unpublished data;~~
~~e. The Canadian Arctic and Greenland struck and lost rate is calculated assuming the rate is 50% for all age classes (DFO 2001; Stenson unpublished data); 2002-2004 average used for 2005.~~
~~f. DFO 2005; Stenson unpublished data; 2001-2004 average used.~~

Fishery Information

U.S.

Detailed fishery information is reported in the Appendix III.

Northeast Sink Gillnet:

Annual estimates of harp seal bycatch in the Northeast sink gillnet fishery reflect seasonal distribution of the species and of fishing effort. There were 200 harp seal mortalities observed in the Northeast sink gillnet fishery between 1990 and 2009. The bycatch occurred principally in winter (January-May) and was mainly in waters from New Hampshire south to the shelf and shelf-edge waters southwest of Cape Cod. The stratification design used for this species is the same as that for harbor porpoise (Bravington and Bisack 1996). Estimated annual mortalities (CV in parentheses) from this fishery were: 81 (0.78) in 1999, 24 (1.57) in 2000, 26 (1.04) in 2001, 0 during 2002-2003, 303 (0.30) in 2004, 35 (0.68) in 2005, 65 (0.66) in 2006, 119 (0.35) in 2007, 238 (0.38) in 2008, ~~and~~ 415 (0.27) in 2009, and ~~378~~259 (0.~~35~~60) in 2010 (Table 2b). There were also 2, 9, 14, 8, 18, 6, ~~and~~ 8 and 5 unidentified seals observed during 2003~~4~~ through 2010~~2009~~ respectively. Since 1997, unidentified seals have not been prorated to a species. This is consistent with the treatment of other unidentified mammals that do not get prorated to a specific species. Average annual estimated fishery-related mortality and serious injury to this stock attributable to this fishery during 2006-2010~~2005-2009~~ was ~~237~~219~~174~~ harp seals (CV=0.~~17~~20~~0.27~~) (Table 2b).

A study on the effects of two different hanging ratios in the bottom set monkfish gillnet fishery on the bycatch of cetaceans and pinnipeds was conducted by NEFSC in 2009 and 2010. Commercial fishing vessels from Massachusetts and New Jersey were used for the study which took place south of the Harbor Porpoise Take Reduction Team Cape Cod South Management Area (south of 40° 40´) in February, March and April. One hundred fifty-nine hauls with eight research strings each were completed during the course of the study. Results showed that while a 0.33 mesh performed better at catching commercially important finfish than a 0.50 mesh, there was no statistical difference in cetacean or pinniped bycatch rates between the two hanging ratios. Nine harp seals were caught in this project during 2009 and one during 2010 (Schnaittacher 2011). These animals are included in the observed interactions and added to the total estimates (Table 2b), though these interactions and their associated fishing effort were not included in bycatch rate calculations.

~~Mid-Atlantic~~mid-Atlantic Gillnet:

No harp seals were taken in observed trips during 1993-1997 or 1999-2006. One harp seal was observed taken in both 1998 and 2007, 4 were taken in 2008, ~~and~~ 3 in 2009, and 1 in 2010. All bycatches were documented during January to April. Using the observed takes, the estimated annual mortality (CV in parentheses) attributed to this fishery was 0 in 1995-1997, 17 in 1998 (1.02), 0 in 1999-2006 38 in 2007, 176 (0.74) in 2008, ~~and~~ 70 (0.67) in 2009, and 32 (0.93) in 2010. Average annual estimated fishery-related mortality attributable to this fishery during 2006-2010~~2005-2009~~ was 63~~57~~ harp seals (CV=0.46~~0.50~~) (Table 2b).

Northeast Bottom Trawl

Four~~Four~~ mortalities were observed in the Northeast bottom trawl fishery between 2002 and 2010~~2009~~. The estimated annual fishery-related mortality and serious injury attributable to this fishery (CV in parentheses) was 0 between 1991 and 2000, 49 (CV=1.10) in 2001, and 0 in 2002-2004, and 0 in 2006–2008, and 2010. Estimates have not been generated for 2005 or 2009.

Table 2b. Summary of the incidental mortality of harp seal (*Pagophilus groenlandicus*) by commercial fishery including the years sampled (Years), 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	Data Type [a]	Observer Coverage [b]	Observed Mortality[c]	Estimated Mortality	Estimated CVs	Mean Annual Mortality
Northeast Sink Gillnet[e]	05-09 06-10	Obs. Data, Trip Logbook, Allocated Dealer Data	.07, .04, .07, .05, .04, .17	3, 3, 11, 14, 32, 78	35, 65, 119, 238, 415, 378259	.68, .66, .35, .38, .27, .3560	24319 (0.1720) 174 (0.18)
Mid-Atlanticmid-Atlantic Gillnet	05-09 06-10	Obs. Data, Trip Logbook, Allocated Dealer Data	.03, .04, .05, .03, .03, .04	0, 0, 1, 4, 3, 1	0, 0, 38, 176, 70, 32	0, 0, 0.9, .74, .67, .93	63 (0.46) 57 (0.5)
Northeast Bottom Trawl[d]	05-09 06-10	Obs. Data Weighout	.12, .06, .06, .08, .09, 0.16	3, 0, 0, 0, 1, 0	unk, 0, 0, 0, unk, 0	unk, 0, 0, 0, unk, 0	unk0.2 (na) [d]
TOTAL							306282 (0.169)231 (0.18)

a. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. The Northeast Fisheries Observer Program collects landings data (Weighout) and total landings are used as a measure of total effort for the sink gillnet fishery. Mandatory logbook (Logbook) data are used to determine the spatial distribution of fishing effort in the Northeast sink gillnet fishery. The 2010 observer coverage in the NE sink gillnet fishery includes the At Sea Monitoring Program coverage.
b. The observer coverages for the Northeast sink gillnet fishery and the mid-Atlantic coastal sink gillnet fisheries are ratios based on tons of fish landed. North Atlantic bottom trawl fishery coverages are ratios based on trips.
c. Since 1998, takes from pingered and non-pingered nets within a marine mammal time/area closure that required pingers, and takes from pingered and non-pingered nets not within a marine mammal time/area closure were pooled. The pooled bycatch rate was weighted by the total number of samples taken from the stratum and used to estimate the mortality. In 2000-200910, respectively, 2, 1, 0, 0, 4, 0, 3, 0, 3, and 4 and 1 -takes were observed in nets with pingers. In 2000-200910, respectively, 1, 0, 0, 0, 11, 3, 0, 12, 15, and 28, and 6 takes were observed in nets without pingers.
d. Bycatch estimates attributed to the Northeast bottom trawl fishery have not been generated. Unexpanded values are provisionally provided.
e. Nine harp seals in 2009 and 1 in 2010 were incidentally caught as part of a NEFSC hanging ratio study to examine the impact of gillnet hanging ratio on harbor porpoise bycatch. These animals were included in the observed interactions and added to the total estimates, though these interactions and their associated fishing effort were not included in bycatch rate calculations.

Other Mortality

Canada: Harp seals have been commercially hunted since the mid-1800s in the Canadian Atlantic (Stenson 1993). A total allowable catch (TAC) of 200,000 harp seals was set for the large vessel hunt in 1971. The TAC varied until 1982 when it was set at 186,000 seals and remained at this level through 1995 (Stenson 1993; ICES 1998). The TAC was increased to 250,000 and 275,000, respectively, in 1996 and 1997 (ICES 1998). The 1997 TAC remained in effect through 2002. In 2003, a three-year TAC was set at 975,000 with a maximum of 350,000 allowed in the first two years (ICES 2008). As a result of catches in the first two years the 2005 TAC was set at 319,517 (ICES 2008). The 2006 TAC was increased to 335,000 (325,000 commercial hunt, 6,000 Aboriginal initiative, and 2,000 allocation each for personal use and Arctic catches). The TAC was reduced to 270,000 in 2007 (263,140 commercial hunt, 4,860 for Aboriginal, and 2,000 for personal use) (ICES 2008). In 2008 the TAC was increased to 275,000 (268,050 commercial hunt, 4,950 for Aboriginal, and 2,000 for personal use). In 2009 the TAC was 280,000, it was increased to 330,000 and in 2010, and to -it was 400,000 in 2011 (DFO 2011, in review).330,000. In recent years hunters have harvested only a small portion (<10%) of the TAC since there are currently few markets for these seal products.

U.S.: From 2006 to 20102005 to 2009, 444511 harp seal stranding mortalities were reported (Table 3; NMFS unpublished data). NineteenTwenty-two ((4.3%) of the mortalities during this five-year period showed signs of human interaction (5 in 2005, 2 in 2006, 6 in 2007, 3 in 2008, 6 in 2009, 2 in 2010 and 64), with 5 having some sign of fishery interaction (1each in 2005, 2007 and 2008 and 2 in 2009)). However, the cause of death of stranded animals is not being evaluated (interactions may be non-fatal or even post-mortem). and is not included in annual human-induced mortality estimates. Harris and Gupta (2006) analyzed NMFS 1996-2002 stranding data and suggest that the distribution of harp seal strandings in the Gulf of Maine is consistent with the species' seasonal migratory patterns in this region.

Table 3. Harp seal (*Pagophilus groenlandicus*) stranding mortalities[a] along the U.S. Atlantic coast (2005-2009) with subtotals of animals recorded as pups in parentheses.

State	2005	2006	2007	2008	2009	Total
ME	10	14	8	15	9	56

NH	2	-	1	1	4	8
MA	44	24	51 (2)	51	59 (2)	229
RI	9	6	2	5	9	31
CT	3	4	1	2	3	13
NY	41	15	19 (1)	8	29	112
NJ	12	3 (1)	3	12	5	35
DE	2 (1)	-	2	-	-	4
MD	2	-	4	1	2	9
VA	4	-	5	3	1	13
NC	-	1	-	-	-	1
Total	**129**	**67**	**96**	**98**	**121**	511
Unspecified seals (all states)	59	46	34	51	34	224

a. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.

Table 3. Harp seal (*Pagophilus groenlandicus*) stranding mortalities [a] along the U.S. Atlantic coast (2006-2010) with subtotals of animals recorded as pups in parentheses.

State	2006	2007	2008	2009	2010	Total
ME	14	8	15	9	13	59
NH	-	1	1	4	1	7
MA	24	51 (2)	51	59 (2)	45	230
RI	6	2	5	9	5	27
CT	4	1	2	3	5	15
NY	15	19 (1)	8	29	22	93
NJ	3 (1)	3	12	5	9	32
DE	-	2	-	-	1	3
MD	-	4	1	2	2	9
VA	-	5	3	1	2	11
NC	1	-	-	-	0	1
Total	**67**	**96**	**98**	**121**	**62**	444
Unspecified seals (all states)	46	34	51	34	22	187

a. Mortalities include animals found dead and animals that were euthanized, died during handling, or died in the transfer to, or upon arrival at, rehab facilities.

STATUS OF STOCK

The level of human-caused mortality and serious injury in the U.S. Atlantic EEZ is also low relative to the total stock size; therefore, this is not a strategic stock.The status of the harp seal stock, relative to OSP, in the U.S.

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

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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). Sperm whales were commercially hunted in the Gulf of Mexico by American whalers from sailing vessels until the early 1900s (Townsend 1935). In the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) systematic aerial and ship surveys indicate that sperm whales inhabit continental slope and oceanic waters where they are widely distributed (Figure 1; Fulling *et al.* 2003; Mullin and Fulling 2004; Mullin *et al.* 2004; Maze-Foley and Mullin 2006; Mullin 2007). 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).

Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), sperm whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).~~The information for southern Gulf of Mexico waters is more limited, but there are sighting and stranding records from each season with sightings widely distributed in continental slope waters of the western Bay of Campeche (Ortega-Ortiz 2002).~~

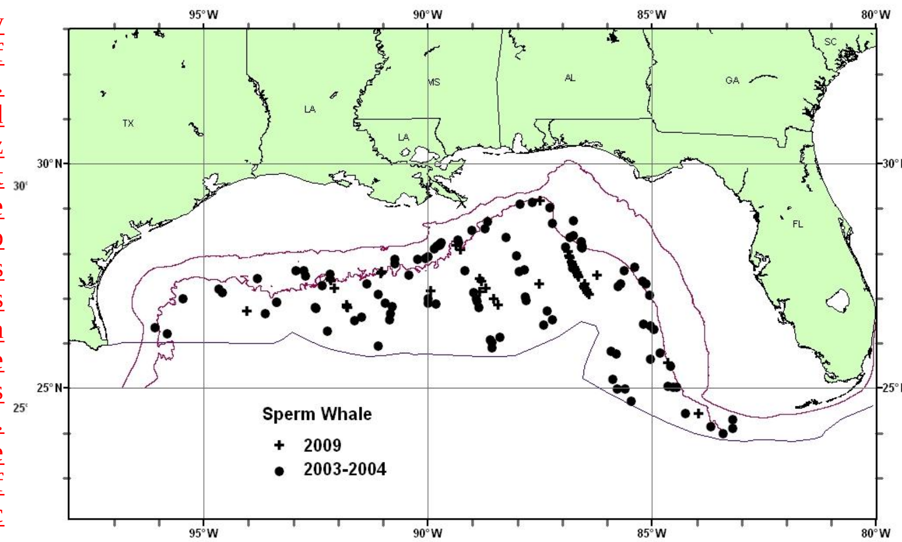

Figure 1. *Distribution of sperm whale sightings from SEFSC ~~spring~~ vessel surveys during ~~1996-2001 and from~~ summer 2003 and spring 2004~~ surveys~~, and during summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Sperm whales throughout the world exhibit a geographic social structure where females and juveniles of both sexes occur in mixed groups and inhabit tropical and subtropical waters. Males, as they mature, initially form bachelor groups but eventually become more socially isolated and more wide-ranging, inhabiting temperate and polar waters as well (Whitehead 2003). While this pattern also applies to the Gulf of Mexico, results of multi-disciplinary research conducted in the Gulf since 2000 confirms speculation by Schmidly (1981) and indicates clearly that Gulf of Mexico sperm whales constitute a stock that is distinct from other Atlantic Ocean stocks(s) (Mullin *et al.* 2003; Jaquet 2006; Jochens *et al.* 2008). The following summarizes the most significant stock structure-related findings from the Sperm Whale Seismic Study (Jochens *et al.* 2008) and associated projects. Measurements of the total length of Gulf of Mexico sperm whales indicate that they are 1.5-2.0m smaller on average compared to whales measured in other areas. Female/immature group size in the Gulf is about one-third to one-fourth that found in the Pacific Ocean but more similar to group sizes in the Caribbean (Richter *et al.* 2008; Jaquet and Gendron 2009). Tracks from 39 whales satellite tagged in the northern Gulf were monitored for up to 607 days. No discernable seasonal migrations were made, but Gulf-wide movements primarily along the northern Gulf slope did occur. The tracks showed that whales exhibit a range of movement patterns within the Gulf, including movement into the southern Gulf in a few cases, but that only 1 whale (a male) left the Gulf of Mexico. This animal moved into the North Atlantic and then back into the Gulf after about 2 months. Additionally, no matches were found when 285 individual whales photo-identified from the Gulf and about 2500 from the North Atlantic and Mediterranean Sea were compared. Engelhaupt *et al.* (2009) conducted an analysis of matrilineally inherited mtDNA and found a significant genetic differentiation between animals from the northern Gulf of Mexico compared to those from the western North Atlantic Ocean, North Sea and Mediterranean Sea. Analysis of biparentally inherited nuclear DNA showed no significant difference between whales sampled in the Gulf and those from the other areas of the North Atlantic, indicating that mature males move in and out of the Gulf. Sperm whales make vocalizations used in a social context called "codas" that have distinct patterns that are apparently culturally transmitted (Watkins and Schevill 1977; Whitehead and Weilgart 1991; Rendell and Whitehead 2001), and based on degree of social affiliation, mixed groups of sperm whales worldwide can be placed in recognizable acoustic clans (Rendell and Whitehead 2003). Recordings from mixed groups in the Gulf of Mexico compared to those from other areas of the Atlantic indicated that Gulf sperm whales constitute a distinct acoustic clan that is rarely encountered outside of the Gulf. It is assumed from this that groups from other clans enter the northern Gulf only infrequently (Gordon *et al.* 2008). Antunes (2009) used additional data to further examine variation in sperm whale coda repertoires in the North Atlantic Ocean, and found that variation in the North Atlantic is mostly geographically structured based on findings of coda patterns unique to certain regions and a significant negative correlation between coda repertoire similarities and geographic distance. His work also suggested sperm whale coda differentiation of the Gulf of Mexico from the North Atlantic.

Additional research by Gero *et al.* (2007) suggested that movements of sperm whales between the adjacent areas of the Caribbean Sea, Gulf of Mexico and Atlantic may not be common. No matches were made from animals photo-identified in the eastern Caribbean Sea (islands of Dominica, Guadeloupe, Grenada, St. Lucia and Martinique) with either animals from the Sargasso Sea or the Gulf of Mexico.

POPULATION SIZE

The best abundance estimate available for northern Gulf of Mexico sperm whales is 763~~1,665~~ (CV=0.38~~0.20); (Mullin 2007; Table 1)~~ Table 1). This estimate is ~~pooled~~ from a summer ~~2003 and spring 2004~~2009 oceanic survey~~s~~ covering waters from the 200-m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~.

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200-m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of sperm whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 530 (CV=0.31) (Hansen *et al.* 1995), and for 1996 to 2001, 1,349 (CV=0.23) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for sperm whales, pooled from 2003 to 2004, was 1,665 (CV=0.20) (Mullin 2007; Table 1).~~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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200-m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of sperm whales for all surveys combined was 530 (CV=0.31) (Hansen *et al.* 1995; Appendix IV). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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; Appendix IV).~~

Recent survey~~s~~ and abundance estimate~~s~~

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico~~ using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for sperm whales in oceanic waters during 2009 was 763 (CV=0.38; Table 1). ~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200-m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for sperm whales in oceanic waters, pooled from 2003 to 2004, was 1,665 (CV=0.20) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico.~~

Table 1. Summary of ~~recent~~ abundance estimates for northern Gulf of Mexico sperm whales. 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
Apr-Jun 1991-1994	Oceanic waters	530	0.31
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	1,349	0.23
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	1,665	0.20
Jun-Aug 2009	Oceanic waters	763	0.38

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 763~~1,665~~ (CV=0.38~~0.20~~). The minimum population estimate for the northern Gulf of Mexico is 560~~1,409~~ sperm whales.

Current Population Trend

~~There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 1,665 (CV=0.20) and that for 1996-2001 of 1,349 (CV=0.29) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is relatively low. These estimates are 2-3 times larger than that for 1991-1994 of 530 (CV=0.31). The 2003-2004 estimates were based on less negatively biased estimates of sperm whale group size and may account for part of the difference. Nevertheless, these temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of sperm whale abundance.~~ Four point estimates of sperm whale abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of more than three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of sperm whale abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 560~~1,409~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 1.1~~2.8~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality or serious injury of a sperm whale during 1998-~~2008~~2010 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield ~~-~~and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2008 there was 1 sperm whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Garrison *et al.* 2009). Also during 2008 there was 1 sperm whale mortality due to entanglement in the sea anchor (parachute anchor and lines) of a longline fishing vessel.

Fisheries Information

~~The level of past or current, direct, human-caused mortality of sperm whales in the northern Gulf of Mexico is unknown.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to sperm whales by this fishery. However, on 2 June 2008 there was 1 sperm whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Garrison *et al.* 2009). The whale was entangled in mainline and other gear and was accompanied by a calf. The mainline broke when the whale dove and gear remained on the animal; however, since it was a large whale it was not considered seriously injured (Garrison and Stokes 2008). This was the first observed interaction between a sperm whale and this fishery. During 15 April – 15 June 2008 observer coverage in the Gulf of Mexico was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. Resulting observer coverage for this time and area is dramatically higher than typical for previous years (Garrison *et al.* 2009).

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).

Other Mortality

~~Three sperm whale strandings were documented during 2008 (1 in Florida, 2 in Texas), and 2 sperm whale strandings were documented during 2007 (1 in Florida, 1 in Texas). No sperm whale strandings were documented during 2004-2006~~There were 8 sperm whale strandings in the northern Gulf of Mexico during 2006-2010 ~~-~~(Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008 and 21 September 2009~~). For 1 stranding, no~~No~~ evidence of human interaction~~s~~ was detected; for ~~these~~ the remaining 7 strand~~ed animals~~ings, it could not be determined if there was evidence of human interactions. During June 2010, 1 dead sperm whale was found floating 77 miles due south of the Deepwater Horizon spill site. It was not found in oiled waters~~,~~; however, the location of its death is unknown. Cause of death is also unknown; the animal did not appear oily. Stranding data probably underestimate the extent of ~~fishery~~human-related mortality and serious injury because not all of the marine mammals which die or are seriously injured in ~~fishery~~human 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~~human interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of fishery interactions.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1

~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 2 animals from this stock were considered to be part of the UME.

~~Seismic vessel operations in the Gulf of Mexico (commercial and academic) now operate with marine mammal observers as part of required mitigation measures. There have been no reported seismic-related or industry ship-related mortalities or injuries to sperm whales. However, 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. Results from very limited studies of northern Gulf of Mexico sperm whale responses to seismic exploration indicate that sperm whales do not appear to exhibit horizontal avoidance of seismic survey activities. Data did suggest that there may be some decrease in foraging effort during exposure to full-array airgun firing, at least for some individuals. Further study is needed as samples sizes are insufficient at this time (Miller *et al.* 2009).~~

Ship strikes to whales occur world-wide and are a source of injury and mortality. One possible sperm whale mortality due to a vessel strike has been documented for the Gulf of Mexico. The incident occurred in 1990 in the vicinity of Grande Isle, Louisiana. Deep cuts on the dorsal surface of the whale indicated the ship strike was probably pre-mortem (Jensen and Silber 2004).

During 2008 there was 1 sperm whale mortality due to entanglement in the sea anchor (parachute anchor and lines) of a longline fishing vessel. The animal was originally identified as "unknown marine mammal," but was later identified to species via genetic testing.

~~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.~~

Table 1. Sperm whale (*Physeter macrocephalus*) strandings along the U.S. Gulf of Mexico coast, 2006-2010.

STATE	**2006**	**2007**	**2008**	**2009**	**2010**	**TOTAL**
Alabama	0	0	0	0	0	0
Florida	0	1	1	0	1	3
Louisiana	0	0	0	0	2*	2
Mississippi	0	0	0	0	0	0
Texas	0	1	2	0	0	3
TOTAL	0	2	3	0	3	8

*These strandings are included in the Northern Gulf of Mexico UME

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, ~~oceanic dolphins~~ the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved,; the amount, frequency and duration of exposure,; the route of exposure (inhaled, ingested, absorbed, or external); and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long--term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

Seismic vessel operations in the Gulf of Mexico (commercial and academic) now operate with marine mammal observers as part of required mitigation measures. There have been no reported seismic-related or industry ship-related mortalities or injuries to sperm whales. However, 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. Results from very limited studies of northern Gulf of Mexico sperm whale responses to seismic exploration indicate that sperm whales do not appear to exhibit horizontal avoidance of seismic survey activities. Data did suggest that there may be some decrease in foraging effort during exposure to full-array airgun firing, at least for some individuals. Further study is needed as samples sizes are insufficient at this time (Miller *et al.* 2009).

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.

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is 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 northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) are from NMFS abundance surveys that were conducted during the spring (Figure 1; Hansen *et al.* 1995, 1996; Mullin and Hoggard 2000; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). However, there are stranding records from throughout the year (Würsig *et al.* 2000).

Although there are no confirmed records from Gulf of Mexico waters beyond U.S. boundaries, Bryde's whales may occur in other parts of the Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico.

It has been postulated that the Bryde's whales found in the northern 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

The best abundance estimate available for northern Gulf of Mexico Bryde's whales is 33~~15~~ (CV=1.07~~1.98);~~ ~~(Mullin 2007;~~ Table 1). This estimate is ~~pooled~~ from a summer 2009~~2003 and spring 2004~~ oceanic survey~~s~~ covering waters from the 200m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~.

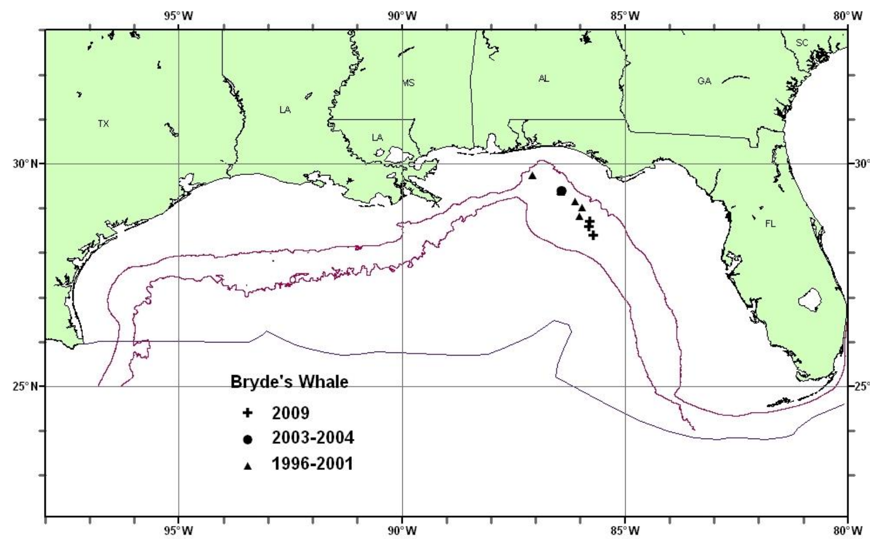

Figure 1. *Distribution of Bryde's whale sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004, and summer 2009 ~~surveys~~. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All ~~E~~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~~ line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200–m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual~~, line-transect vessel~~ surveys were conducted ~~in conjunction with bluefin tuna ichthyoplankton surveys~~ during spring ~~in the northern Gulf of Mexico oceanic waters, from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean sSurveys were conducted~~ along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the ~~S~~survey effort-weighted estimated average abundance of Bryde's whales for all surveys combined was estimated. ~~from~~ For 1991 ~~through~~ to 1994, the estimate was 35 (CV=1.10) (Hansen *et al.* 1995~~; Table 1~~), and for 1996 to 2001, ~~.~~

~~Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. Due to limited survey effort in any given year, survey effort was pooled across all years to develop an average abundance estimate. The~~ abundance ~~estimate of abundance for Bryde's whales in oceanic waters, pooled from 1996 to 2001, was~~ 40 (CV=0.61) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, ~~line-transect~~ surveys dedicated to estimating cetacean abundance ~~were~~were conducted along ~~conducted in the northern Gulf of Mexico. During each year,~~ a grid of uniformly-spaced transect lines from a random start~~was surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter*~~. The abundance estimate for Bryde's whales~~in oceanic waters~~, pooled from 2003 to 2004, was 15 (CV=1.98) (Mullin 2007; Table 1).

Recent surveys and abundance estimates

~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start was surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for Bryde's whales in oceanic waters, pooled from 2003 to 2004, was 15 (CV=1.98) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico.~~ During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico~~using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for Bryde's whales in oceanic waters during 2009 was 33 (CV=1.07; Table 1).

Table 1. Summary of abundance estimates for northern Gulf of Mexico Bryde's whales. 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
Apr-Jun 1991-1994	Oceanic waters	35	1.10
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	40	0.61
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	15	1.98
Jun-Aug 2009	Oceanic waters	33	1.07

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 33~~15~~ (CV=1.07~~1.98~~). The minimum population estimate for the northern Gulf of Mexico is 16~~5~~ Bryde's whales.

Current Population Trend

~~There are insufficient data to determine the population trends for this stock. The pooled abundance estimate for 2003-2004 of 15 (1.98) and that for 1996-2001 of 40 (CV=0.61) are not significantly different (P>0.05) from each other but due to the imprecision of the estimates, the power to detect a difference is low. The abundance estimate for 1991-1994 was 35 (CV=1.09). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of Bryde's whale abundance. The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and~~

distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance. Four point estimates of Bryde's whale abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly three but the precision of the estimates is very poor. The vast majority of the small number of Bryde's whale sightings from each survey occurred in a very restricted area of the northeastern Gulf (Figure 1) during surveys that uniformly sampled the entire oceanic northern Gulf. Because the population size is small, in order to effectively monitor trends in Bryde's whale abundance in the future, other methods need to be used, such as line-transect surveys that focus fine scale survey effort specifically on the area they inhabit or mark-recapture studies. Additionally, whales need to be satellite tagged to determine whether they use this area exclusively or travel to other areas.

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 bBiological rRemoval 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 516. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery"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 0.160.1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Annual human-caused mortality and serious injury is unknown for this stock. There is no documented mortality or serious injury associated with commercial fishing. During 2009 there was 1 known Bryde's whale mortality as a result of a ship strike. For the period 20052006 through 20092010, the minimum annual rate of human-caused mortality and serious injury to Bryde's whales due to ship strikes was 0.2 per year. Detected mortalities should not be considered an unbiased representation of human-caused mortality. Detections are haphazard and not the result of a designed sampling scheme. As such they represent a minimum estimate of human-caused mortality which is almost certainly biased low.

Fisheries Information

The level of past or current, direct, human-caused mortality of Bryde's whales in the northern Gulf of Mexico is unknown. The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There has been no reported fishing-related mortality or serious injury of a Bryde's whale by this fishery during 1998-20092010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Other Mortality

There were 2 reported strandings of Bryde's whales in the Gulf of Mexico during 2006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011). During 2009 a Bryde's whale was found floating in the Port of Tampa (Florida). The whale had evidence of premortem and postmortem blunt trauma, and was determined to have been struck by a ship, draped across the bow and carried into port. The whale was a lactating female and measured 12.65m in length (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 17 November 2010). There were no reported strandings of Bryde's whales in the Gulf of Mexico during 1999-2005 nor during 2007-2008. One Bryde's whale calf live-stranded in Sandestin, Florida, during November 2006. No evidence of human interaction was detected for this stranded animal. ~~(NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 17 November 2010).~~ Stranding data probably underestimate the extent of human-caused mortality and serious injury because not all of the marine mammals which die or are seriously injured from human 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 vessel collision, 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 human interactions.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010~~,~~; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans,~~For oceanic dolphins~~ the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. For large whales, oil can foul the baleen they use to filter-feed. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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 stock. Total human-caused mortality and serious injury for this stock is not known but one human-caused mortality was documented during 2009. This is a strategic stock because the average annual human-caused mortality and serious injury exceeds 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 (i.e., U.S. 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. Beaked whale sightings made during spring and summer vessel surveys have been widely distributed in waters >500m deep (Maze-Foley and Mullin 2006; Figure 1).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), Cuvier's beaked whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for Cuvier's beaked whales in the northern Gulf of Mexico is 74~~65~~ (CV=1.04~~0.67);~~ ~~(Mullin 2007;~~ Table 1). This estimate is ~~pooled~~ from a summer 2009 ~~2003 and spring 2004~~ oceanic survey~~s~~ covering waters from the 200m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~. However, this abundance estimate 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 74~~337~~ (CV=1.04~~0.40~~), which may also include an unknown number of ~~*Mesoplodon* spp~~Cuvier's beaked whales.

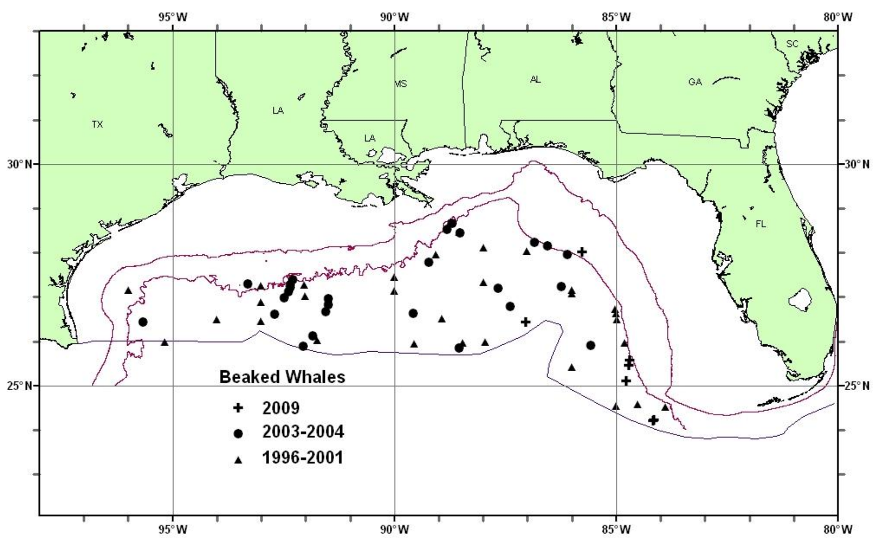

Figure 1. *Distribution of beaked whale sightings from SEFSC shipboard ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004 ~~surveys~~, and summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All ~~E~~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~~line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S EEZ), and are summarized in Appendix IV.

~~-~~ From 1991 through 1994, and from 1996 to 2001 (excluding 1998), annual ~~line-transect vessel~~ surveys were conducted ~~in conjunction with bluefin tuna ichthyoplankton surveys~~ during spring ~~in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted~~ along a fixed plankton~~-~~-sampling trackline. Due to limited survey effort in any given year, the ~~S~~survey effort-weighted estimated average abundance of Cuvier's beaked whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 30 (CV=0.50) (Hansen *et al.* 1995), and for ~~(Table 1).~~

~~Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, ~~was~~ 95 (CV=0.47) (Mullin and Fulling 2004; Table 1). The estimated abundance of Cuvier's beaked whales was 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 was 146 (CV=0.46), which may have also included an unknown number of ~~*Mesoplodon* spp~~Cuvier's beaked whales.

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for Cuvier's beaked whales, pooled from 2003 to 2004, was 65 (CV=0.67) (Mullin 2007; Table 1). The estimate for the same time period for unidentified Ziphiidae was 337 (CV=0.40), which may have also included an unknown number of Cuvier's beaked whales.

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico ~~using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for Cuvier's beaked whales in oceanic waters during 2009 was 74 (CV=1.04; Table 1). The estimate for the same time period for unidentified Ziphiidae was also 74 (CV=1.04), which may have also included an unknown number of Cuvier's beaked whales.

~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship Gordon Gunter (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for Cuvier's beaked whales in oceanic waters, pooled from 2003 to 2004, was 65 (CV=0.67) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico. The estimate for the same time period for unidentified Ziphiidae was 337 (CV=0.40), which may also include an unknown number of Mesoplodon spp.~~

Table 1. Summary of abundance estimates for northern Gulf of Mexico Cuvier's beaked whales. 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
Apr-Jun 1991-1994	Oceanic waters	30	0.50
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	95	0.47
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	65	0.67
Jun-Aug 2009	Oceanic waters	74	1.04

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 74~~65~~ (CV=1.04~~0.67~~). The minimum population estimate for the northern Gulf of Mexico is 36~~39~~ Cuvier's beaked whales.

Current Population Trend

Four point estimates of Cuvier's beaked whale abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of more than three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of Cuvier's beaked whale abundance.~~There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 65 (CV=0.67) and that for 1996-2001 of 95 (CV=0.47) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of Cuvier's beaked whale abundance. The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 36~~39~~. 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 0.4.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a Cuvier's beaked whale during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2007 there was 1 unidentified beaked whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Fairfield and Garrison 2008).

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.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to Cuvier's beaked whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al*. 2009; Garrison and Stokes 2010; 2011). However, during 2007, 1 unidentified beaked whale was observed entangled and released alive in the northern Gulf of Mexico. All gear was removed and the animal was presumed to have no serious injuries (Fairfield and Garrison 2008).

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 ~~was 1~~were no reported strandings of a Cuvier's beaked whale in the Gulf of Mexico during ~~1999-2007~~2006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008~~). ~~One Cuvier's beaked whale stranded in Texas in October 2004. No evidence of human interaction was detected for this stranded animal. 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010;~~,~~ and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with military naval activities. During the mid- to late 1980's 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~~active 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.* 2006). 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 were performed on 5 of the dead beaked whales and 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.* 2006).

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, ~~oceanic dolphins~~ the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

STATUS OF STOCK

The status of Cuvier's beaked whales and 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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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 (i.e., U.S. 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). Beaked whale sightings made during spring and summer vessel surveys have been widely distributed in waters >500m deep (Maze-Foley and Mullin 2006; Figure 1). Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), Blainville's beaked whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The total number of Blainville's beaked whales in the northern Gulf of Mexico is unknown. The best available abundance estimate is for *Mesoplodon* spp., and is a combined estimate for Blainville's beaked whale and Gervais' beaked whale. The estimate of abundance for *Mesoplodon* spp. in oceanic waters, using data ~~pooled~~ from a summer 2009~~2003 and spring 2004~~ oceanic survey~~s~~, is ~~57~~149 (CV=0.91~~1.40)~~; ~~(Mullin 2007;~~ Table 1).

Earlier abundance estimates

All ~~E~~estimates of abundance were derived through the application of distance sampling analysis

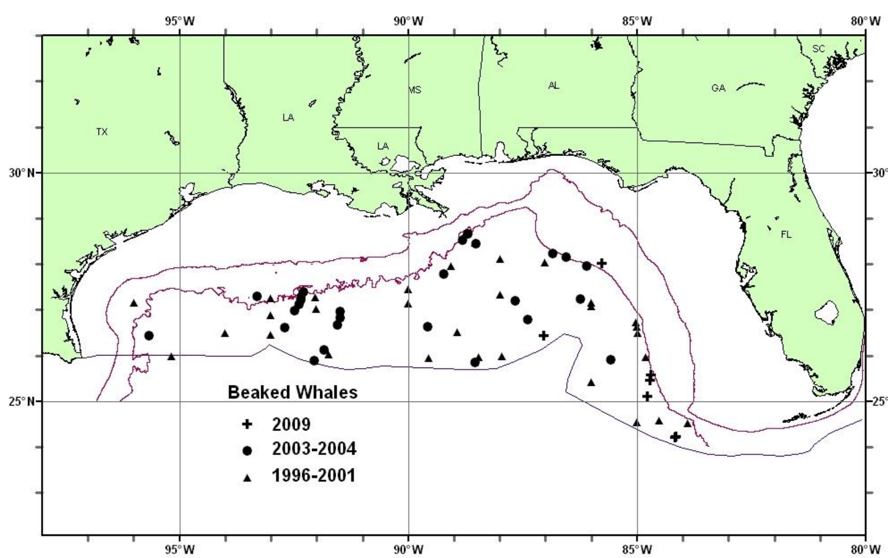

Figure 1. *Distribution of beaked whale sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004~~, surveys~~ and summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

(Buckland *et al.* 2001) and the computer program DISTANCE (Thomas *et al.* 1998) to ~~sighting~~line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual~~line-transect vessel~~ surveys were conducted ~~in conjunction with bluefin tuna ichthyoplankton surveys~~ 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). Annual cetacean surveys were conducted~~ along a fixed plankton-~~-~~sampling trackline. Due to limited survey effort in any given year during 1991-1994, the ~~S~~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. For 1996 to 2001, the

survey effort-weighted estimated average ~~Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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,~~ was 106 (CV=0.41) (Mullin and Fulling 2004; Table 1). This was a combined estimate for ~~Gervais' beaked whale and~~ Blainville's and Gervais' beaked whales. The estimate for the same time period for unidentified Ziphiidae was 146 (CV=0.46) which may have also included an unknown number of ~~Cuvier's~~Blainville's beaked whales.

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The estimate of abundance for *Mesoplodon* spp., pooled from 2003 to 2004, was 57 (CV=1.40) (Mullin 2007; Table 1). This was a combined estimate for Blainville's and Gervais' beaked whales. The estimate for the same time period for unidentified Ziphiidae was 337 (CV=0.40), which may have also included an unknown number of Blainville's beaked whales.

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico ~~using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The estimate of abundance for *Mesoplodon* spp. in oceanic waters during 2009 was 149 (CV=0.91; Table 1). This was a combined estimate for Blainville's and Gervais' beaked whales. The estimate for the same time period for unidentified Ziphiidae was 74 (CV=1.04), which may have also included an unknown number of Blainville's beaked whales.~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for *Mesoplodon* spp. in oceanic waters, pooled from 2003 to 2004, was 57 (CV=1.40) (Mullin 2007; Table 1), 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 was 337 (CV=0.40), which may also include an unknown number of Cuvier's beaked whales.~~

Table 1. Summary of ~~recent~~ abundance estimates for northern Gulf of Mexico *Mesoplodon* spp., which is a combined estimate for Blainville's beaked whale and Gervais' beaked 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
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	106	0.41
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	57	1.40
Jun-Aug 2009	Oceanic waters	149	0.91

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 14957 (CV=0.911.40). The minimum population estimate for *Mesoplodon* spp. in the northern Gulf of Mexico is 7724.

Current Population Trend

There are insufficient data to determine the population trends for this species due to uncertainty in species identification at sea. Three point estimates of *Mesoplodon* spp. abundance have been made based on data from surveys covering 1996-2009. The estimates vary by a maximum factor of nearly three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of *Mesoplodon* abundance.There are insufficient data to determine the population trends for this species due to uncertainty in species identification at sea. The pooled abundance estimate for *Mesoplodon* spp. for 2003-2004 of 57 (CV=1.40) and that for 1996-2001 of 106 (CV=0.41) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of *Mesoplodon* abundance. The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 bBiological rRemoval 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 7724. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery"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 0.80.2. 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 1998-20072010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2007 there was 1 unidentified beaked whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Fairfield and Garrison 2008).

Fisheries Information

The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). 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 northern Gulf of Mexico. There were no reports of mortality or serious injury to Blainville's or other beaked whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2007, 1 unidentified beaked whale was observed entangled and released alive in the northern Gulf of Mexico. All gear was removed and the animal was presumed to have no serious injuries (Fairfield and Garrison 2008).

Other Mortality

There were no strandings of *Mesoplodon* spp. or unidentified beaked whales during ~~2004-2007~~2006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011). ~~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. No evidence of human interactions was detected for these stranded animals (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 September 2008).~~ 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.

~~In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 UMEs have been declared in the Gulf of Mexico~~Since 1990, there have been 12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 1 of these included Blainville's beaked whales. Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *Karenia brevis* blooms and fish kills in the Florida Panhandle. Additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, and 4 unidentified dolphins. An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010~~,~~; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with military naval activities. During the mid- to late 1980's 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~~active 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.* 2006). 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 were performed on 5 of the dead beaked whales and 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.* 2006).

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, ~~oceanic dolphins~~ the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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 (i.e., U.S. Gulf of Mexico) from 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). Beaked whale sightings made during spring and summer vessel surveys have been widely distributed in waters >500m deep (Maze-Foley and Mullin 2006; Figure 1).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), Gervais' beaked whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The total number of Gervais' beaked whales in the northern Gulf of Mexico is unknown. The best available abundance estimate is for *Mesoplodon* spp., and is a combined estimate for Gervais' beaked whale and Blainville's beaked whale. The estimate of abundance for *Mesoplodon* spp. in oceanic waters, using data ~~pooled~~ from a summer 2009~~2003 and spring 2004~~ oceanic survey~~s~~, is 149~~57~~ (CV=0.91~~1.40); (Mullin 2007;~~ Table 1).

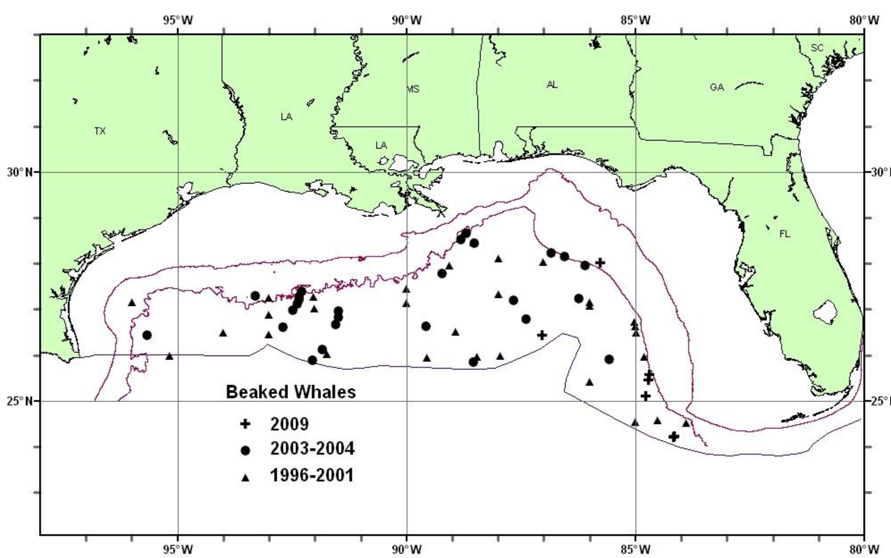

Figure 1. *Distribution of beaked whale sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001, ~~and from~~ summer 2003 and spring 2004 ~~surveys~~, and summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year during 1991-1994, the 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. For 1996 to 2001, the survey effort-weighted estimated average abundance for *Mesoplodon* spp. was 106 (CV=0.41) (Mullin and Fulling 2004; Table 1). This was a combined estimate for Blainville's and Gervais' beaked whales. The estimate for the same time period for unidentified Ziphiidae was 146 (CV=0.46) which may have also included an unknown number of Gervais' beaked whales.

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The estimate of abundance for *Mesoplodon* spp., pooled from 2003 to 2004, was 57 (CV=1.40) (Mullin 2007; Table 1). This was a combined estimate for Blainville's and Gervais' beaked whales. The estimate for the same time period for unidentified Ziphiidae was 337 (CV=0.40), which may have also included an unknown number of Gervais' beaked whales.

Earlier abundance estimates

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 in conjunction with bluefin tuna ichthyoplankton surveys 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). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. 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). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 106 (CV=0.41) (Mullin and Fulling 2004; Table 1). This was a combined estimate for Blainville's beaked whale and Gervais' beaked whale. The estimate for the same time period for unidentified Ziphiidae was 146 (CV=0.46), which may also include an unknown number of Cuvier's beaked whales.

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The estimate of abundance for *Mesoplodon* spp. in oceanic waters during 2009 was 149 (CV=0.91; Table 1). This is a combined estimate for Blainville's and Gervais' beaked whales. The estimate for the same time period for unidentified Ziphiidae was 74 (CV=1.04), which may have also included an unknown number of Gervais' beaked whales.During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extend of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for *Mesoplodon* spp. in oceanic waters, pooled from 2003 to 2004, was 57 (CV=1.40) (Mullin 2007; Table 1), 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 was 337 (CV=0.40), which may also include an unknown number of Cuvier's beaked whales.

Table 1. Summary of recent abundance estimates for northern Gulf of Mexico *Mesoplodon* spp., which is a combined estimate for Gervais' beaked whale and Blainville's beaked 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
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	106	0.41
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	57	1.40
Jun-Aug 2009	Oceanic waters	149	0.91

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 14957 (CV = 0.911.40). The minimum population estimate for *Mesoplodon* spp. in the northern Gulf of Mexico is 7724.

Current Population Trend

There are insufficient data to determine the population trends for this species due to uncertainty in species identification at sea. The pooled abundance estimate for *Mesoplodon* spp. for 2003-2004 of 57 (CV=1.40) and that for 1996-2001 of 106 (CV=0.41) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of *Mesoplodon* abundance. Three point estimates of *Mesoplodon* spp. abundance have been made based on data from surveys covering 1996-2009. The estimates vary by a maximum factor of nearly three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of *Mesoplodon* abundance. The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 bBiological rRemoval 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 7724. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery"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 0.80.2. 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 1998-20072010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2007 there was 1 unidentified beaked whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Fairfield and Garrison 2008).

Fisheries Information

The level of past or current, direct, human-caused mortality of beaked whales in the northern Gulf of Mexico is unknown. The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to Gervais' or other beaked whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2007, 1 unidentified beaked whale was observed entangled and released alive in the northern Gulf of Mexico. All gear was removed and the animal was presumed to have no serious injuries (Fairfield and Garrison 2008).

Other Mortality

There were no strandings of *Mesoplodon* spp. or unidentified beaked whales during 2006-20102004-2007. 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. No evidence of human interactions was detected for these stranded animals (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011September 2008). 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010,; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

Several unusual mass strandings of beaked whales in North Atlantic marine environments have been associated with military naval activities. During the mid- to late 1980's 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 acousticactive 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.* 2006). 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 were performed on 5 of the dead beaked whales and 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.* 2006).

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For continental shelf and oceanic cetaceans, oceanic dolphins the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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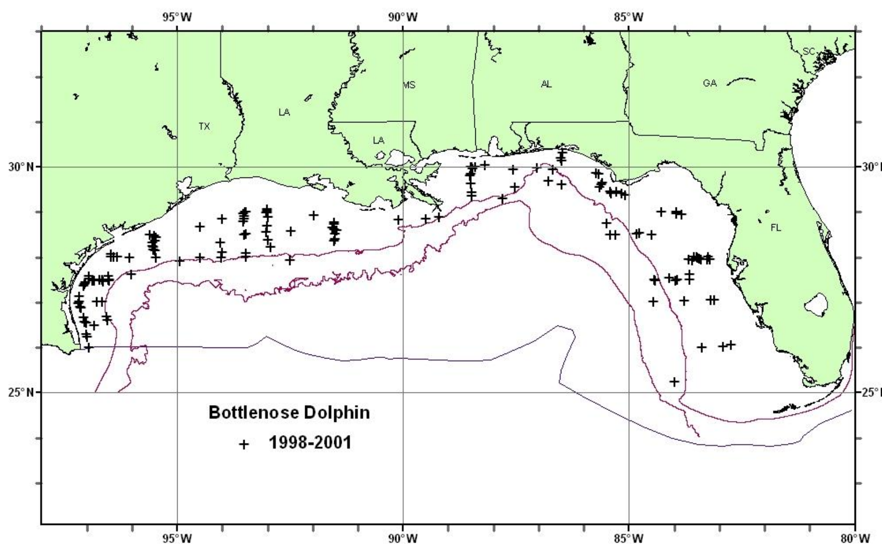
BOTTLENOSE DOLPHIN (*Tursiops truncatus* ***truncatus***): Northern Gulf of Mexico Continental Shelf Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

The northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) ~~c~~Continental ~~s~~Shelf Stock of bottlenose dolphins ~~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 occur in the Gulf of Mexico (Hersh and Duffield 1990; LeDuc and Curry 1998). The ~~c~~Continental ~~s~~Shelf ~~s~~Stock probably consists of a mixture of both the coastal and offshore ecotypes. The offshore and coastal 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 34 km from shore. The offshore ecotype was found exclusively seaward of 34km and in waters deeper than 34 m. 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. A stranded dolphin from the Florida Panhandle~~, genetically intermediate between coastal and offshore forms,~~ was rehabilitated and released over the shelf off western Florida, and traveled into the Atlantic Ocean (Wells *et al.* 1999).



100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.

The bottlenose dolphins inhabiting waters <20m deep in the northern Gulf are believed to constitute 36 inshore or coastal stocks. An oceanic stock is provisionally defined for bottlenose dolphins inhabiting waters >200 m. Both inshore and coastal stocks and the oceanic stock are separate from the continental shelf stock, but the continental shelf stock may overlap with coastal stocks and the oceanic stock in some areas and may be genetically indistinguishable from some of those stocks. However, studies have shown significant genetic differentiation between inshore stocks and coastal/continental shelf stocks along the central west coast of Florida (Sellas *et al.* 2005).

Based on research currently being conducted on bottlenose dolphins in the northern 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 ~~38~~41 years (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 northern Gulf of Mexico. As research is completed, it may be necessary to revise stocks of bottlenose dolphins in the northern Gulf of Mexico.

POPULATION SIZE

The current population size for the bottlenose dolphin continental shelf stock in the northern Gulf of Mexico is unknown because the survey data ~~from the continental shelf~~ are more than 8 years old. Estimates using data older than 8 years are deemed unreliable,; and, therefore, should not be used for PBR determinations (Wade and Angliss 1997).

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* (2000) and *Gordon Gunter* (1998, 1999, 2001). Tracklines, which were perpendicular to the bathymetry, covered shelf waters from the 20-m to the 200-m 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 ~~previous~~most recent abundance estimate of bottlenose dolphins from the Continental Shelf Stock was based on data pooled from 2000 through 2001 for continental shelf vessel surveys and was 17,777 (CV=0.32) (see Fulling *et al.* 2003). ~~As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates using data older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations. Because data from the continental shelf are more than 8 years old, the current best population estimate is unknown.~~

Minimum Population Estimate

The minimum population estimate is unknown. 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 unknown. The minimum population estimate for the northern Gulf of Mexico is unknown.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate from the 2000-2001 ship survey of 17,777 (CV=0.32) 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 90.5ºW. 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 9.3 km past the 18 m (10 fm) curve to 9.3 km past 183 m (100 fm) 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 dolphins 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 ~~b~~Biological ~~r~~Removal ~~level~~ (PBR) is undetermined. PBR is the product of the minimum population size, one half the maximum net productivity rate and a ~~"recovery"~~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"~~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.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

One serious injury occurred in the Southeastern U.S. Atlantic, Gulf of Mexico, Caribbean snapper-grouper and other reef fish fishery during 2010. One mortality occurred during 2010 incidental to oil rig platform removal operations when an animal became entangled in line and drowned. One mortality during 2008 in the shrimp trawl fishery may have come from the continental shelf stock.

There has been no reported fishing-related mortality of bottlenose dolphins in the pelagic longline fishery during 1998-2007 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008). However, during 2007 there was 1 bottlenose dolphin released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Fairfield and Garrison 2008). There were 3 interactions with the shark bottom longline fishery, including one mortality, during 1994-2003, and none during 2004-2007 (Burgess and Morgan 2003a,b; Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007).

Fisheries Information

The commercial fisheries which potentially could interact with this stock in the Gulf of Mexico are: Southeastern U.S. Atlantic, Gulf of Mexico shark bottom longline fishery; Southeastern U.S. Atlantic, Gulf of Mexico shrimp trawl fishery, Southeastern U.S. Atlantic, Gulf of Mexico, Caribbean snapper-grouper and other reef fish fishery; and the Gulf of Mexico butterfish trawl fishery (Appendix III). 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.

One serious injury occurred in the Southeastern U.S. Atlantic, Gulf of Mexico, Caribbean snapper-grouper and other reef fish fishery during 2010. A bottlenose dolphin was hooked in the rostrum and line was wrapped around the rostrum. The injured animal was likely from the Continental Shelf Stock. Fishery interactions have been reported to occur between bottlenose dolphins and the pelagic longline fishery in the Gulf of Mexico (SEFSC unpublished logbook data). During 2007, 1 bottlenose dolphin was observed entangled and released alive by the pelagic longline fishery in the northern Gulf of Mexico. All gear was removed and the animal was presumed to have no serious injuries (Fairfield and Garrison 2008). This animal could have belonged to the continental shelf or oceanic stock. Annual fishery-related mortality and serious injury to bottlenose dolphins from the pelagic longline fishery was estimated to be 2.8 per year (CV=0.74) during 1992-1993. This could include bottlenose dolphins from the oceanic stock.

The shark bottom longline fishery has been observed since 1994, and 3 interactions with bottlenose dolphins have been recorded in the northern Gulf of Mexico. The incidents include 1 mortality (2003) and 2 hooked animals that escaped at the vessels (1999, 2002; Burgess and Morgan 2003a,b; Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007). Based on the water depths of the interactions (~12-60m), they likely involved animals from the eastern coastal and continental shelf stocks. For the shark bottom longline fishery in the northern Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively. The shark bottom longline fishery has been observed since 1994, and 3 interactions with bottlenose dolphins have been recorded. The incidents include 1 mortality (2003) and 2 hooked animals that escaped at the vessels (1999, 2002; Burgess and Morgan 2003a,b). Based on the water depths of the interactions (12m, 29m and 60m), they likely involved animals from the Eastern Coastal and Continental Shelf Stocks. No interactions were observed during 2004-2010 (Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007; Hale *et al.* 2009; 2010; 2011). For the shark bottom longline fishery in the Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively.

A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. Four bottlenose dolphin mortalities were observed in the shrimp trawl fishery during 2003, 2007, 2008 and 2010. The 2008 mortality occurred off the Texas coast and could have belonged to the Western Coastal Stock or Continental Shelf Stock. During 2009, 1 bottlenose dolphin was released alive presumably with no serious injury after becoming entangled in the lazy line of a shrimp trawl. This animal could have belonged to the Continental Shelf Stock or the Western Coastal Stock. During 1992-2008 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 or more of these animals may have belonged to the Eastern or Northern Coastal stocks, and it is likely that 3-4 of the animals belonged to the Continental Shelf Stock or the Atlantic spotted dolphin (*Stenella frontalis*) stock. In 2 of the 6 cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed because there was no necropsy. In 2008, an additional dolphin carcass was caught on the tickler chain of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. It is likely the unidentified carcass belonged to the bottlenose dolphin Western Coastal stock or Continental Shelf Stock, or possibly to the Atlantic spotted dolphin stock.~~Two bottlenose dolphin mortalities were observed during 2003 and 2007 which could have belonged to either a coastal or a bay, sound and estuarine stock. During 1992-2007 the shrimp trawl fishery observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 or more of these animals may have belonged to the continental shelf stock of bottlenose dolphins. In 2 of the 6 cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed in the absence of a necropsy.~~

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980's 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 had been no reports of either serious injury or mortality to bottlenose dolphins until 2010 (NMFS unpublished data). One mortality occurred during 2010 when a bottlenose dolphin became entangled in a diver's guide line during platform removal operations. A diver discovered the dolphin at a depth of 25.9m and reported it to be motionless and unresponsive with both tail flukes caught in poly guide line, which was being used to transfer equipment to the sea floor. No explosives were involved in this incident.

A total of ~~1,425~~1,340 bottlenose dolphins were found stranded in the northern Gulf of Mexico from ~~2003~~2006 through ~~2007~~2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008~~). Of these, ~~82~~114 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, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Wells *et al.* 1998; Gorzelany 1998), and some are struck by vessels (Wells and Scott 1997). The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal or bay, sound and ~~estuarine~~estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins belonged to the ~~c~~Continental ~~s~~Shelf or ~~o~~Oceanic ~~s~~Stocks and that they were among those strandings with evidence of human interactions. (Strandings do occur for other cetacean species whose primary range in the Gulf of Mexico is outer continental shelf or oceanic waters.)

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010~~,~~; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 221 bottlenose dolphins were considered to be part of the UME. The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins considered part of the UME belonged to the Continental Shelf Stock.

~~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).~~

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For oceanic dolphins the NOAA-led effortsFor continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Despite an undetermined PBR and unknown population size, this is not a strategic stock because previous estimates of population size have been large compared to the number of cases of documented human-related mortality and serious injury.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Gulf of Mexico Eastern Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. 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 climatic, 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 outer 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~~region 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. It is bordered on the north by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. ~~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 freshwater 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 freshwater input.~~

Portions of the coastal stocks may co-occur with the northern Gulf of Mexico ~~c~~Continental ~~s~~Shelf ~~s~~Stock and bay, sound and ~~estuarine~~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 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~~Vollmer 2011), 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; Rosel *et al.* 2009). 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. Because the continental shelf is much wider in the Gulf, results from the Atlantic may not apply.

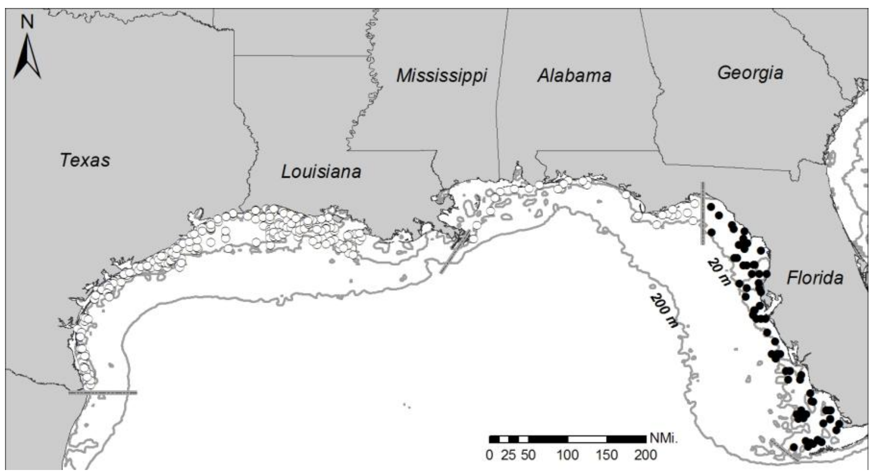

Figure 1. *Locations (circles) of bottlenose dolphin groups sighted in coastal waters during aerial surveys conducted in the Western Coastal ~~s~~Stock area in 1992 and 1996, and in the Northern Coastal ~~s~~Stock and Eastern Coastal ~~s~~Stock areas in 2007. Dark circles indicate groups within the boundaries of the Eastern Coastal ~~s~~Stock. The 20 and 200m isobaths are shown.*

Research on coastal stocks is limited. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and ~~Charlotte Harbor/Pine Island Sound~~Lemon Bay, Florida, over 14 months. They found coastal waters were inhabited by both 'inshore' and 'Gulf' dolphins but that the 2 types used coastal waters differently. Dolphins from the inshore communities were observed occasionally in Gulf near-shore waters adjacent to their inshore range, whereas 'Gulf' dolphins were found primarily in open Gulf of Mexico waters with some displaying seasonal variations in their use of the study area. The 'Gulf' dolphins did not show a preference for waters near passes as was seen for 'inshore' dolphins, but moved throughout the study area and made greater use of waters offshore of waters used by 'inshore' dolphins. During winter months abundance of 'Gulf' groups decreased while abundance for 'inshore' groups increased. These findings support an earlier report by Irvine *et al.* (1981) of increased use of pass and coastal waters by Sarasota Bay dolphins in winter. Seasonal movements of identified individuals and abundance indices suggest that part of the 'Gulf' dolphin community moves out of the study area during winter, but their destination is unknown. Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, and the coastal Gulf of Mexico (1-12km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and ~~estuarine~~estuary stocks from those occurring in adjacent Gulf coastal waters, as suggested by Wells (1986).

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 and Würsig 2002).

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Eastern Coastal ~~s~~Stock of bottlenose dolphins is 7,702 (CV=0.19), and is a result of aerial surveys conducted during summer 2007.

Earlier abundance estimates

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. The previous bottlenose dolphin abundance estimate for the Eastern Coastal ~~s~~Stock based on the 1994 survey was 9,912 (CV=0.12).

Recent surveys and abundance estimates

Current ~~A~~abundance estimates for the Northern and Eastern Coastal ~~s~~Stocks were derived from aerial surveys conducted during 17 July to 8 August 2007. Survey effort covered waters from the shoreline to 200m depth and was stratified such that the majority of effort was expended in the 0-20m depth range of the coastal stocks. The survey team consisted of an observer stationed at each of two forward bubble windows and a third observer stationed at a belly window that monitored the trackline. Surveys were typically flown during favorable sighting conditions at Beaufort sea state less than or equal to 3 (surface winds <10 knots). Abundance estimates were derived using distance analysis including environmental covariates that had a significant influence on sighting probability (Buckland *et al.*, 2001), but these estimates were not corrected for *g(0)* and are thus negatively biased. The resulting abundance estimate for the ~~e~~Eastern Coastal ~~s~~Stock was 7,702 animals (CV=0.19).

Minimum Population Estimate

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 best estimate of abundance for the Eastern Coastal ~~s~~Stock of bottlenose dolphins is 7,702 (CV=0.19). The minimum population estimate for the northern Gulf of Mexico Eastern Coastal ~~s~~Stock is 6,551 bottlenose dolphins.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. 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 ~~b~~Biological ~~r~~Removal ~~level~~ (PBR) is the product of minimum population size, one-half the maximum productivity rate and a ~~"recovery"~~recovery factor (Wade and Angliss 1997). The minimum population size is 6,551. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 Eastern Coastal ~~s~~Stock of bottlenose dolphins is 66.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the Eastern Coastal ~~s~~Stock of bottlenose dolphins during ~~2004-2008~~2006-2010 is unknown.

Fisheries Information

The commercial fisheries which potentially could interact with the Eastern Coastal ~~s~~Stock in the northern Gulf of Mexico are the shark bottom longline, shrimp trawl, blue crab trap/pot, ~~and~~ stone crab trap/pot, spiny lobster trap/pot, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Hook and Line Fisheries

During 2006 there were 2 mortalities, and during 2009, 1 mortality, for which hook and line gear entanglement or ingestion were documented in the stranding database. During 2010 an attempt was made to disentangle 1 live animal from hook and line gear. The mortalities and live entanglement were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011) and are included in the stranding totals presented in Table 1.

Shark Bottom Longline Fishery

The shark bottom longline fishery has been observed since 1994, and 3 interactions with bottlenose dolphins have been recorded. The incidents include 1 mortality (2003) and 2 hooked animals that escaped at the vessels (1999, 2002; Burgess and Morgan 2003a,b). Based on the water depths of the interactions (12m, 29m and 60m)~~(~12-60m)~~, they likely involved animals from the Eastern Coastal and ~~c~~Continental ~~s~~Shelf ~~s~~Stocks. No interactions were observed during 2004-~~2008~~2010 (Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007; Hale *et al.* 2009; 2010; 2011). For the shark bottom longline fishery in the Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively.

Shrimp Trawl Fishery

~~Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery.~~ A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. ~~Three~~Four bottlenose dolphin mortalities were observed during 2003, 2007, ~~and~~ 2008 and 2010 which could have belonged to bay, sound and ~~estuarine~~estuary stocks, the Western Coastal ~~s~~Stock, the Northern Coastal ~~s~~Stock and the ~~c~~Continental ~~s~~Shelf ~~s~~Stock. During 1992-2008 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 or more of these animals may have belonged to the Eastern or Northern Coastal ~~s~~Stocks, and it is likely that 3-4 of the animals belonged to the ~~c~~Continental ~~s~~Shelf ~~s~~Stock or the Atlantic spotted dolphin (*Stenella frontalis*) stock. In 2 of the 6 cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed because there was no~~in the absence of a~~ necropsy. ~~In 2008, an additional dolphin carcass was caught on the tickler of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. This cannot be confirmed without a necropsy. It is likely the unidentified carcass belonged to the bottlenose dolphin Western Coastal stock or continental shelf stock, or possibly to the Atlantic spotted dolphin stock.~~

Blue and Stone Crab and Spiny Lobster Trap/Pot Fisheries

~~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. In 2002 there was a calf stranded near Clearwater, Florida, with crab trap line wrapped around its rostrum, through its mouth and looped around its tail. There was an additional unconfirmed report to the stranding network in 2002 of a dolphin entangled in a stone crab trap with the buoy still attached. The animal was reportedly cut loose from the trap and slowly swam off with line and buoy still wrapped around it (NMFS unpublished data). In 2008, a dolphin was disentangled from crab trap gear in Texas from a concerned citizen and swam away with no reported injuries. Also in 2008, a dolphin off Florida, reportedly half the size of an adult, was disentangled by a county marine officer from a crab pot line and swam away with no reported injuries (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.~~

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. During 2010, 3 dolphins likely belonging to the Eastern Coastal Stock were disentangled from probable stone crab trap gear in Florida and swam away in unknown condition. Also during 2010, 1 mortality was documented in which an animal was entangled in unidentified crab trap/pot gear. During 2008, another dolphin off Florida likely belonging to the Eastern Coastal Stock, reportedly half the size of an adult, was disentangled from a crab pot line and swam away with no reported injuries. The mortality and live entanglements were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011) and are included in the stranding totals presented in Table 1. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Strandings

A total of ~~86~~64 bottlenose dolphins were found stranded in Eastern Coastal waters of the northern Gulf of Mexico from ~~2004~~2006 through ~~2008~~2010 (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~21 September 2009 and 18 November 2009~~16 November 2011). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for ~~5~~10 of these dolphins. Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

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 ~~estuarine~~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.

Since 1990, there have been ~~11~~12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 3 of these have occurred within the boundaries of the Eastern Coastal Stock and may have affected the stock. 1) 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). 2) An unusual mortality event was declared for Sarasota Bay, Florida, in 1991, but the cause was not determined. 3) ~~In March and April 1992, 111 bottlenose dolphins stranded in Texas, about 9 times the average number. The cause of this event was not determined, but carbamates were a suspected cause.~~

~~In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 bottlenose dolphin UMEs have been declared in~~

the Gulf of Mexico. 1) In 1993-1994 an UME of bottlenose dolphins likely 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). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. 2) In 1996 an UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. 3) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins). 4) In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 106 bottlenose dolphins and 1 unidentified dolphin stranded dead (NMFS 2004). Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). 5) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins (plus strandings of 1 Atlantic spotted dolphin, *S. frontalis*, and 24 unidentified dolphins). The evidence suggests the effects of a red tide bloom contributed to the cause of this event. 6) A separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins). 7) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 66 bottlenose dolphins. Decomposition prevented conclusive analyses on most carcasses. 8) During February and March of 2008 an additional event was declared in Texas involving 113 bottlenose dolphin strandings. Most of the animals recovered were in a decomposed state. The event has been closed, however, the investigation is ongoing. In addition, an UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010,; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from the Eastern Coastal Stock were considered to be part of this UME.

Table 1. Bottlenose dolphin strandings occurring in Eastern Coastal stock waters of the northern Gulf of Mexico from 2004 to 2008, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 21 September 2009 and 18 November 2009). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that strandings in coastal waters have been separated by coastal stock and separated from bay, sound and estuarine stocks; therefore, the annual totals below will differ from those reported previously.

Stock	Category	2004	2005	2006	2007	2008	Total
Eastern Coastal Stock	Total Stranded	8	36	31	4	7	86
	Human Interaction	0	1	2	0	2	5
	---Fishery Interaction	-	0	2	-	2	4
	---Other	-	1	0	-	0	1
	No Human Interaction	2	9	5	1	1	18

	~~CBD~~	~~6~~	~~26~~	~~24~~	~~3~~	~~4~~	~~63~~

Table 1. Bottlenose dolphin strandings occurring in Eastern Coastal Stock waters of the northern Gulf of Mexico from 2006 to 2010, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 16 November 2011). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that strandings in coastal waters have been separated by coastal stock and separated from bay, sound and estuary stocks; therefore, the annual totals below will differ from those reported previously. Finally, there were an additional 24 dolphins not included in this or any other table that stranded either in bay, sound and estuary waters or in coastal waters that could not be assigned definitively to a stock due to bad location data. If/when the location data are resolved, the numbers below could increase.

Stock	**Category**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Eastern Coastal Stock	Total Stranded	30[a]	4	7	11	12	64
	Human Interaction						
	---Yes	2	0	2	1	5	10
	---No	5	1	1	5	1	13
	---CBD	23	3	4	5	6	41

[a] This total includes 28 animals that were part of the 2005-2006 UME

Other Mortality

The problem of dolphin depredation of fishing gear is increasing in the Gulf of Mexico. There have been 3 recent cases of fishermen illegally "taking" dolphins due to dolphin depredation of recreational and commercial fishing gear. In 2006 a charter boat fishing captain was charged under the MMPA for shooting at a dolphin that was swimming around his catch in the Gulf of Mexico, off Panama City, Florida. In 2007 a second charter fishing boat captain was fined under the MMPA for shooting at a bottlenose dolphin that was attempting to remove a fish from his line in the Gulf of Mexico, off Orange Beach, Alabama. A commercial fisherman was indicted in November 2008 for throwing pipe bombs at dolphins off Panama City, Florida, and charged in March 2009 for "taking" dolphins with an explosive device.

Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011~~, in press~~), and also in Texas near Corpus Christi (Bryant 1994). 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, a high rate of uncontrolled provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004), and provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells 2011~~, in press~~). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, an estimated 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011~~, in press~~). Swimming with wild bottlenose dolphins has also been documented. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

~~The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs 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 16-46μg/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), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). 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).

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs 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 16-46µg/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), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). 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).

STATUS OF STOCK

The status of the Eastern Coastal sStock 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. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury is insignificant and approaching zero mortality and serious injury rate. Additionally, there is no systematic monitoring of all fisheries that may take this stock. 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. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. 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 climatic, 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 outer 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 extends 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 ~~s~~Stock area is characterized by a temperate climate, barrier islands, sand beaches, coastal marshes and marsh islands, and has a relatively high level of freshwater input. It is bordered on the east by an extensive area of coastal marsh and marsh islands typical of Florida's Apalachee Bay. ~~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 freshwater input.~~

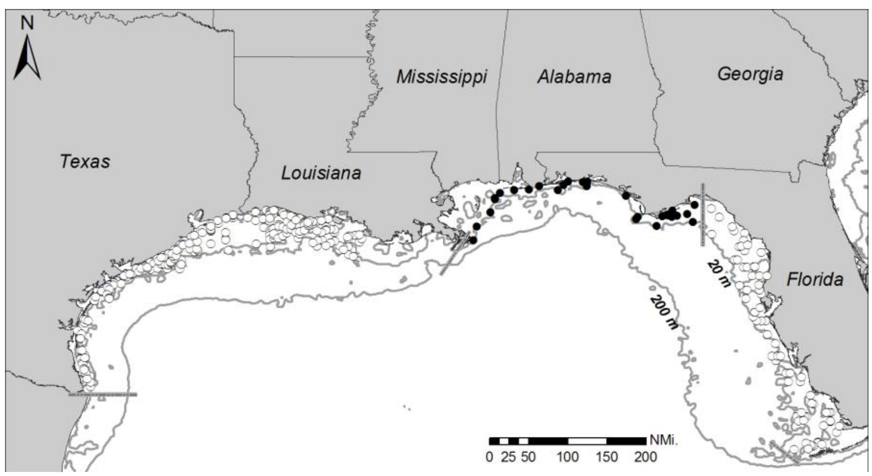

Figure 1. *Locations (circles) of bottlenose dolphin groups sighted in coastal waters during aerial surveys conducted in the Western Coastal ~~s~~Stock area in 1992 and 1996, and in the Northern Coastal ~~s~~Stock and Eastern Coastal ~~s~~Stock areas in 2007. Dark circles indicate groups within the boundaries of the Northern Coastal Stock. The 20 and 200m isobaths are shown.*

Portions of the coastal stocks may co-occur with the northern Gulf of Mexico ~~c~~Continental ~~s~~Shelf ~~s~~Stock and bay, sound and ~~estuarine~~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 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~~Vollmer 2011), 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; Rosel *et al.* 2009). 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. Because the continental shelf is much wider in the Gulf, results from the Atlantic may not apply.

Research on coastal stocks is limited. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and ~~Charlotte Harbor/Pine Island Sound~~Lemon Bay, Florida, over 14 months. They found coastal waters were inhabited by both 'inshore' and 'Gulf' dolphins but that the 2 types used coastal waters differently. Dolphins from the inshore communities were observed occasionally in Gulf near-shore waters adjacent to their inshore range, whereas 'Gulf' dolphins were found primarily in open Gulf of Mexico waters with some displaying seasonal variations in their use of the study area. The 'Gulf' dolphins did not show a preference for waters near passes as was seen for 'inshore' dolphins, but moved throughout the study area and made greater use of waters offshore of waters used by 'inshore' dolphins. During winter months abundance of 'Gulf' groups decreased while abundance for 'inshore' groups increased. These findings support an earlier report by Irvine *et al.* (1981) of increased use of pass and coastal waters by Sarasota Bay dolphins in winter. Seasonal movements of identified individuals and abundance indices suggest that part of the 'Gulf' dolphin community moves out of the study area during winter, but their destination is unknown. Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, and the coastal Gulf of Mexico (1-12km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and ~~estuarine~~estuary stocks from those occurring in adjacent Gulf coastal waters, as suggested by Wells (1986).

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 and Würsig 2002).

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico Northern Coastal ~~s~~Stock of bottlenose dolphins is 2,473 (CV=0.25), and is a result of aerial surveys conducted during summer 2007.

Earlier abundance estimates

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. The previous bottlenose dolphin abundance estimate for the Northern Coastal ~~s~~Stock based on the 1993 survey was 4,191 (CV=0.21).

Recent surveys and abundance estimates

Current abundance estimates for the Northern and Eastern Coastal Stocks were derived from aerial surveys conducted during 17 July to 8 August 2007. Survey effort covered waters from the shoreline to 200m depth and was stratified such that the majority of effort was expended in the 0-20m depth range of the coastal stocks. The survey team consisted of an observer stationed at each of two forward bubble windows and a third observer stationed at a belly window that monitored the trackline. Surveys were typically flown during favorable sighting conditions at Beaufort sea state less than or equal to 3 (surface winds <10 knots). Abundance estimates were derived using Distance analysis including environmental covariates that had a significant influence on sighting probability (Buckland *et al.*, 2001), but these estimates were not corrected for *g(0)* and are thus negatively biased. The resulting abundance estimate for the Northern Coastal Stock was 2,473 (CV = 0.25).

Minimum Population Estimate

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 best estimate of abundance for the Northern Coastal ~~s~~Stock of bottlenose dolphins is 2,473 (CV=0.25). The minimum population estimate for the Northern Coastal ~~s~~Stock is 2,004 bottlenose dolphins.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. 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 ~~b~~Biological ~~r~~Removal ~~level~~ (PBR) is the product of minimum population size, one-half the maximum productivity rate and a ~~"recovery"~~recovery factor (Wade and Angliss 1997). The minimum population size is 2,004. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 Northern Coastal ~~s~~Stock of bottlenose dolphins is 20.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the Northern Coastal ~~s~~Stock of bottlenose dolphins during ~~2004-2008~~2006-2010 is unknown.

Fisheries Information

The commercial fisheries which potentially could interact with the Northern Coastal ~~s~~Stock in the northern Gulf of Mexico are the shrimp trawl, blue crab trap/pot, stone crab trap/pot, menhaden purse seine, gillnet, ~~and~~ shark bottom longline, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Shrimp Trawl Fishery

~~Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery.~~ A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. ~~Three~~Four bottlenose dolphin mortalities were observed in the shrimp trawl fishery during 2003, 2007, 2008 and 2010. ~~One mortality occurred in 2008 off the coast of Texas in the vicinity of Laguna Madre, 1 mortality occurred in 2007 off the coast of Louisiana in the vicinity of Atchafalaya Bay, and 1 mortality occurred in 2003 off the coast of Alabama near Mobile Bay. The Texas 2008 mortality could have belonged to the bottlenose dolphin Western Coastal stock or continental shelf stock. The Louisiana 2007 mortality could have belonged to the Western Coastal stock or a bay, sound and estuarine stock. The Alabama 2003 mortality could have belonged to the Northern Coastal stock or a bay, sound and estuarine stock.~~ The 2003 mortality occurred off the coast of Alabama and could have belonged to the Northern Coastal Stock or a bay, sound and estuary stock (Mobile Bay, Bonsecour Bay Stock or Mississippi Sound, Lake Borgne, Bay Boudreau Stock). During 1992-2008 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 or more of these animals may have belonged to the Eastern or Northern Coastal ~~s~~Stocks, and it is likely that 3-4 of the animals belonged to the ~~c~~Continental ~~s~~Shelf ~~s~~Stock or the Atlantic spotted dolphin (*Stenella frontalis*) stock. In 2 of the 6 cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed ~~in the absence of a~~because there was no necropsy. ~~In 2008, an additional dolphin carcass was caught on the tickler of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. This cannot be confirmed without a necropsy. It is likely the unidentified carcass belonged to the bottlenose dolphin Western Coastal stock or continental shelf stock, or possibly to the Atlantic spotted dolphin stock.~~

Blue and Stone Crab Trap/Pot Fisheries

~~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. In 2002 there was a calf stranded near Clearwater, Florida, with crab trap line wrapped around its rostrum, through its mouth and looped around its tail. There was an additional unconfirmed report to the stranding network in 2002 of a dolphin entangled in a stone crab trap with the buoy still attached. The animal was reportedly cut loose from the trap and slowly swam off with line and buoy still wrapped around it (NMFS unpublished data). In 2008, a dolphin was disentangled from crab trap gear in Texas from a concerned citizen and swam away with no reported injuries. Also in 2008, a dolphin off Florida, reportedly half the size of an adult, was disentangled by a county~~

~~marine officer from a crab pot line and swam away with no reported injuries (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009). Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.~~

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. Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots. There have been no reported mortalities for the Northern Coastal Stock to date. However, mortalities have been reported for the Eastern Coastal Stock, Western Coastal Stock, and bay, sound and estuary stocks.

Menhaden Purse Seine Fishery

~~There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). Through the Marine Mammal Authorization Program, there have been 11 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery: 2 takes of single bottlenose dolphins were reported in Louisiana waters during 2005 (1 of the animals may have been dead prior to capture); 1 take of a single bottlenose dolphin was reported in Louisiana waters during 2004; 2 takes of single unidentified dolphins were reported during 2002 (1 in Mississippi and 1 in Louisiana waters); 1 take of a single bottlenose dolphin was reported in Louisiana waters during 2001; and 3 takes were reported in 2000, 2 of which were for single dolphins (1 bottlenose, 1 unidentified) in Louisiana waters and the third was for 3 bottlenose dolphins in a single purse seine in Mississippi waters. The menhaden purse seine 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.~~ There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). Through the Marine Mammal Authorization Program, there have been 11 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery. These takes likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; Mississippi River Delta Stock; and Barataria Bay Estuarine System Stock. One take of a single bottlenose dolphin was reported in Louisiana waters during 2001 (likely belonged to Mississippi River Delta Stock or Northern Coastal Stock). Three takes were reported in 2000, 2 of which were for single dolphins (1 bottlenose, 1 unidentified) in Louisiana waters (likely belonged to Western Coastal Stock and either Mississippi River Delta Stock or Northern Coastal Stock), and the third was for 3 bottlenose dolphins in a single purse seine in Mississippi waters (likely belonged to Mississippi Sound, Lake Borgne, Bay Boudreau Stock). The menhaden purse seine 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.

Gillnet Fishery

No marine mammal mortalities associated with gillnet fisheries have been reported for the Northern Coastal Stock, but stranding data suggest that gillnet and marine mammal interaction does occur in the Gulf of Mexico, causing mortality and serious injury. Four research-related gillnet mortalities occurred between 2003 and 2007 in Texas and Louisiana. Additionally, in 2008, 1 dolphin was entangled in a fisheries research gillnet in Texas. ~~The floatline was wrapped around the dolphin's tail; the net released itself upon retrieval and the dolphin appeared in good condition as it swam away.~~ All of these animals likely belonged to bay, sound and estuary~~ine~~ stocks. In 1995, a Florida state constitutional amendment banned gillnets and large nets from bay, sounds, estuaries and other inshore waters.

Shark Bottom Longline Fishery

The shark bottom longline fishery has been observed since 1994, and no interactions have been reported for the Northern Coastal Stock. However, ~~-~~3 interactions with bottlenose dolphins ~~have been~~were recorded during 1999, 2002 and 2003 (Burgess and Morgan 2003a,b) which~~. The incidents include 1 mortality (2003) and 2 hooked animals that escaped at the vessels (1999, 2002; Burgess and Morgan 2003a,b). Based on the water depths of the interactions (~12-60m), they~~ likely involved animals from the Eastern Coastal and ~~c~~Continental ~~s~~Shelf ~~s~~Stocks. No interactions with any bottlenose dolphin stock were observed during 2004-~~2008~~2010 (Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007; Hale *et al.* 2009; 2010; 2011). ~~For the shark bottom longline fishery in the Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively.~~

Hook and Line Fisheries

There have been no recent documented interactions between hook and line fisheries and the Northern Coastal Stock. However, mortalities and entanglements have been documented for the Eastern Coastal Stock, Western Coastal Stock, and bay, sound and estuary stocks.

Strandings

A total of ~~139~~75 bottlenose dolphins were found stranded in Northern Coastal Stock waters of the Gulf of Mexico from ~~2004~~2006 through ~~2008~~2010 (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~21 September 2009 and 18 November 2009~~16 November 2011). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for ~~3~~4 of these dolphins. Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

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 ~~estuarine~~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.

Since 1990, there have been ~~11~~12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 7 of these have occurred within the boundaries of the Northern Coastal Stock and may have affected the stock. 1) 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). ~~An unusual mortality event was declared for Sarasota Bay, Florida, in 1991, but the cause was not determined. In March and April 1992, 111 bottlenose dolphins stranded in Texas, about 9 times the average number. The cause of this event was not determined, but carbamates were a suspected cause.~~

~~In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 bottlenose dolphin UMEs have been declared in the Gulf of Mexico. 1~~2) In 1993-1994 an UME of bottlenose dolphins likely 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). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. ~~2~~3) In 1996 an UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. ~~3~~4) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins). 45) In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 1056 bottlenose dolphins and 21 unidentified dolphins stranded dead (NMFS 2004). Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). 5) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins (plus strandings of 1 Atlantic spotted dolphin, *S. frontalis*, and 24 unidentified dolphins). The evidence suggests the effects of a red tide bloom contributed to the cause of this event. 6) A separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins). 7) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 66 bottlenose dolphins. Decomposition prevented conclusive analyses on most carcasses. 8) During February and March of 2008 an additional event was declared in Texas involving 113 bottlenose dolphin strandings. Most of the animals recovered were in a decomposed state. The event has been closed, however, the investigation is ongoing.7) An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010,; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 14 animals from this stock were considered to be part of the UME.

Table 1. Bottlenose dolphin strandings occurring in Northern Coastal stock waters of the northern Gulf of Mexico from 2004 to 2008, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 21 September 2009 and 18 November 2009). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that strandings in coastal waters have been separated by coastal stock and separated from bay, sound and estuarine stocks; therefore, the annual totals below will differ from those reported previously.

Stock	Category	2004	2005	2006	2007	2008	Total
Northern Coastal Stock	Total Stranded	59	21	32	19	8	139
	Human Interaction	0	1	1	1	0	3
	---Fishery Interaction	-	1	0	0	-	1
	---Other	-	0	1	1	-	2
	No Human Interaction	12	3	3	3	1	22
	CBD	47	17	28	15	7	114

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waters have been separated by coastal stock and separated from bay, sound and estuary stocks; therefore, the annual totals below will differ from those reported previously. Finally, there were an additional 24 dolphins not included in this or any other table that stranded either in bay, sound and estuary waters or in coastal waters that could not be assigned definitively to a stock due to bad location data. If/when the location data are resolved, the numbers below could increase.

Stock	Category	2006	2007	2008	2009	2010	Total
Northern Coastal Stock	Total Stranded	27[a]	18	7	8	15[b]	75
	Human Interaction						
	---Yes	1	1	0	1	1	4
	---No	3	3	1	3	3	13
	---CBD	23	14	6	4	11	58

[a] This total includes 15 animals that were part of the 2005-2006 UME
[b] This total includes 14 animals that are part of the ongoing UME in the northern Gulf of Mexico

Other Mortality

The problem of dolphin depredation of fishing gear is increasing in the Gulf of Mexico. There have been 3 recent cases of fishermen illegally "taking" dolphins due to dolphin depredation of recreational and commercial fishing gear. In 2006 a charter boat fishing captain was charged under the MMPA for shooting at a dolphin that was swimming around his catch in the Gulf of Mexico, off Panama City, Florida. In 2007 a second charter fishing boat captain was fined under the MMPA for shooting at a bottlenose dolphin that was attempting to remove a fish from his line in the Gulf of Mexico, off Orange Beach, Alabama. A commercial fisherman was indicted in November 2008 for throwing pipe bombs at dolphins off Panama City, Florida, and charged in March 2009 for "taking" dolphins with an explosive device.

Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011, in press), and also in Texas near Corpus Christi (Bryant 1994). 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, a high rate of uncontrolled provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004), and provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells 2011, in press). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, an estimated 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011, in press). Swimming with wild bottlenose dolphins has also been documented. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs 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 16-46µg/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), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). 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 one 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.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs 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 16-46µg/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), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). 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 one 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.

STATUS OF STOCK

——The status of the Northern Coastal sStock 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. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury is insignificant and approaching zero mortality and serious injury rate. Additionally, there is no systematic monitoring of all fisheries that may take this stock. 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. ~~This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.~~Because an UME of unprecedented size and duration (began 1 February 2010 and is ongoing) has impacted the Northern Coastal Stock area, NMFS considers this stock to be strategic.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*): Gulf of Mexico Western Coastal Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins inhabit coastal waters throughout the northern Gulf of Mexico (i.e., U.S. 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 climatic, coastal and/or 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 outer 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 t~~The Western Coastal bottlenose dolphin stock area extends 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 freshwater input.~~ Th~~e~~is ~~Western Coastal stock area~~region 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 freshwater input.

The Western Coastal ~~s~~Stock is trans-boundary with Mexico; however, there is no information available for abundance estimation, nor for estimating fishery-related mortality in Mexican waters.

Portions of the coastal stocks may co-occur with the northern Gulf of Mexico ~~c~~Continental ~~s~~Shelf ~~s~~Stock and bay, sound and ~~estuarine~~estuary stocks. The seaward boundary for coastal stocks, the 20m isobath, generally corresponds to survey strata (Scott 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~~Vollmer 2009), 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; Rosel *et al.* 2009). 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 34 m. Within 7.5 km of shore, all animals were of the coastal ecotype. The distance of the 20-m isobath ranges from 4 to 90 km from shore in the northern Gulf. Because the continental shelf is much wider in the Gulf, results from the Atlantic may not apply.

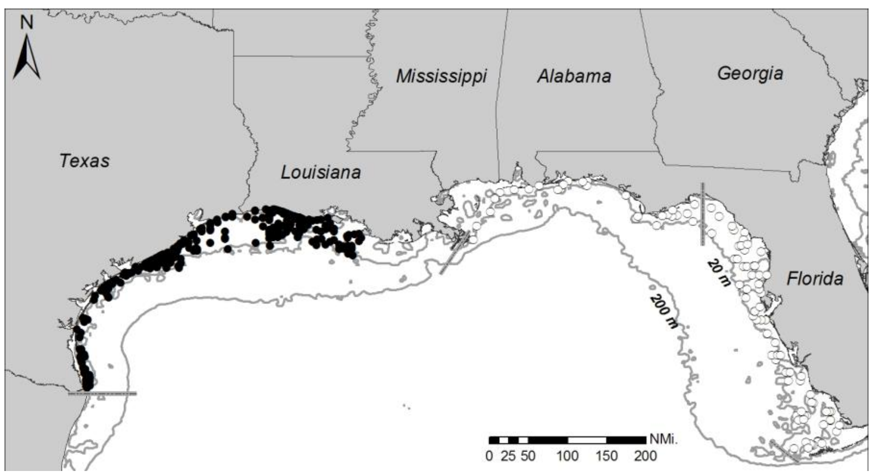

Figure 1. *Locations (circles) of bottlenose dolphin groups sighted in coastal waters during aerial surveys conducted in the Western Coastal ~~s~~Stock area in 1992 and 1996, and in the Northern Coastal ~~s~~Stock and Eastern Coastal ~~s~~Stock areas in 2007. Dark circles indicate groups within the boundaries of the Western Coastal ~~s~~Stock. The 20 and 20-0m isobaths are shown.*

Research on coastal stocks is limited. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and ~~Charlotte Harbor/Pine Island Sound~~Lemon Bay, Florida, over 14 months.

They found coastal waters were inhabited by both ‘inshore’ and ‘Gulf’ dolphins but that the 2 types used coastal waters differently. Dolphins from the inshore communities were observed occasionally in Gulf near-shore waters adjacent to their inshore range, whereas ‘Gulf’ dolphins were found primarily in open Gulf of Mexico waters with some displaying seasonal variations in their use of the study area. The ‘Gulf’ dolphins did not show a preference for waters near passes as was seen for ‘inshore’ dolphins, but moved throughout the study area and made greater use of waters offshore of waters used by ‘inshore’ dolphins. During winter months abundance of ‘Gulf’ groups decreased while abundance for ‘inshore’ groups increased. These findings support an earlier report by Irvine *et al.* (1981) of increased use of pass and coastal waters by Sarasota Bay dolphins in winter. Seasonal movements of identified individuals and abundance indices suggest that part of the ‘Gulf’ dolphin community moves out of the study area during winter, but their destination is unknown. Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, and the coastal Gulf of Mexico (1-12km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and ~~estuarine~~estuary stocks from those occurring in adjacent Gulf coastal waters, as suggested by Wells (1986).

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 and Würsig 2002).

POPULATION SIZE

Population size estimates for this stock are greater than 8 years old and therefore the current population size for the stock is considered unknown (Wade and Angliss 1997).

~~Earlier a~~Abundance estimates

~~Previous~~The most recent 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 9 km past the 18-m isobath. Approximately 5% of the total survey area was visually searched. The ~~previous~~ bottlenose dolphin abundance estimate for the Western Coastal ~~s~~Stock based on the 1992 survey was 3,499 (CV=0.21).

Minimum Population Estimate

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 best estimate of abundance for the Western Coastal ~~s~~Stock of bottlenose dolphins is unknown. Therefore, the minimum population estimate for the northern Gulf of Mexico Western Coastal ~~s~~Stock is unknown.

Current Population Trend

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

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for this stock. 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 ~~b~~Biological ~~r~~Removal ~~level~~ (PBR) is the product of minimum population size, one-half the maximum productivity rate and a ~~“recovery”~~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”~~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 Western Coastal ~~s~~Stock of bottlenose dolphins is undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the Western Coastal ~~s~~Stock of bottlenose dolphins during ~~2004-2008~~2006-2010 is unknown.

Fisheries Information

The commercial fisheries which potentially could interact with the Western Coastal ~~s~~Stock in the northern Gulf of Mexico are the shrimp trawl, blue crab trap/pot, stone crab trap/pot, menhaden purse seine, gillnet, ~~and~~ shark bottom longline, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Hook and Line Fisheries

During 2010 there was 1 mortality in Texas for which hook and line gear entanglement was documented. The mortality was included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011) and is included in the stranding totals presented in Table 1.

Shrimp Trawl Fishery

~~Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery.~~ A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. Four~~Three~~ bottlenose dolphin mortalities were observed in the shrimp trawl fishery during 2003, 2007, 2008 and 2010. The 2010 mortality occurred off the Louisiana coast and likely belonged to the Western Coastal Stock. The 2008 mortality occurred off the Texas coast and could have belonged to the Western Coastal Stock or Continental Shelf Stock. The 2007 mortality occurred off the Louisiana coast and could have belonged to the Western Coastal Stock or a bay, sound and estuary stock (Mobile Bay, Bonsecour Bay Stock or Mississippi Sound, Lake Borgne, Bay Boudreau Stock). During 2009, 1 bottlenose dolphin was released alive presumably with no serious injury after becoming entangled in the lazy line of a shrimp trawl. This animal could have belonged to the Continental Shelf Stock or the Western Coastal Stock. ~~One mortality occurred in 2008 off the coast of Texas in the vicinity of Laguna Madre, 1 mortality occurred in 2007 off the coast of Louisiana in the vicinity of Atchafalaya Bay, and 1 mortality occurred in 2003 off the coast of Alabama near Mobile Bay. The Texas 2008 mortality could have belonged to the bottlenose dolphin Western Coastal stock or continental shelf stock. The Louisiana 2007 mortality could have belonged to the Western Coastal stock or a bay, sound and estuarine stock. The Alabama 2003 mortality could have belonged to the Northern Coastal stock or a bay, sound and estuarine stock. During 1992-2008 the observer program recorded an additional 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 or more of these animals may have belonged to the Eastern or Northern Coastal stocks, and it is likely that 3-4 of the animals belonged to the continental shelf stock or the Atlantic spotted dolphin (*Stenella frontalis*) stock. In 2 of the 6 cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed in the absence of a necropsy.~~ In 2008, ~~an additional~~a dolphin carcass was caught on the tickler chain of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. ~~This cannot be confirmed without a necropsy.~~ It is likely the unidentified carcass belonged to the bottlenose dolphin Western Coastal ~~s~~Stock or ~~c~~Continental ~~s~~Shelf ~~s~~Stock, or possibly to the Atlantic spotted dolphin stock.

Blue and Stone Crab Trap/Pot Fisheries

~~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. In 2002 there was a calf stranded near Clearwater, Florida, with crab trap line wrapped around its rostrum, through its mouth and looped around its tail. There was an additional unconfirmed report to the stranding network in 2002 of a dolphin entangled in a stone crab trap with the buoy still attached. The animal was reportedly cut loose from the trap and slowly swam off with line and buoy still wrapped around it (NMFS unpublished data). In 2008, a dolphin was disentangled from crab trap gear in Texas from a concerned citizen and swam away with no reported injuries. Also in 2008, a dolphin off Florida, reportedly half the size of an adult, was disentangled by a county marine officer from a crab pot line and swam away with no reported injuries (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 21 September 2009 and 18 November 2009).~~

~~Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.~~

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. In 2008, a dolphin likely belonging to the Western Coastal Stock was disentangled from crab trap gear in Texas by a concerned citizen and swam away with no reported injuries (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011). Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Menhaden Purse Seine Fishery

There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). Through the Marine Mammal Authorization Program, there have been 11 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery. These takes likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; Mississippi River Delta Stock; and Barataria Bay Estuarine System Stock. ~~2~~Two takes of single bottlenose dolphins were reported in Louisiana waters during 2005 (both likely belonged to the Western Coastal Stock; ~~(~~1 of the animals may have been dead prior to capture)~~;~~. ~~1 take of a single bottlenose dolphin was reported in Louisiana waters during 2004; 2 takes of single unidentified dolphins were reported during 2002 (1 in Mississippi and 1 in Louisiana waters); 1 take of a single bottlenose dolphin was reported in Louisiana waters during 2001; and 3~~Three takes were reported in 2000, 2 of which were for single dolphins (1 bottlenose, 1 unidentified) in Louisiana waters (likely belonged to Western Coastal Stock and either Mississippi River Delta Stock or Northern Coastal Stock), and the third was for 3 bottlenose dolphins in a single purse seine in Mississippi waters (likely belonged to Mississippi Sound, Lake Borgne, Bay Boudreau Stock). The menhaden purse seine 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.

Gillnet Fishery

No marine mammal mortalities associated with gillnet fisheries have been reported for the Western Coastal Stock, but stranding data suggest that gillnet and marine mammal interaction does occur, causing mortality and serious injury. Four research-related gillnet mortalities occurred between 2003 and 2007 in Texas and Louisiana. Additionally, in 2008, 1 dolphin was entangled in a fisheries research gillnet in Texas. ~~The floatline was wrapped around the dolphin's tail; the net released itself upon retrieval and the dolphin appeared in good condition as it swam away.~~ All of these animals likely belonged to bay, sound and ~~estuarine~~estuary stocks. ~~In 1995, a Florida state constitutional amendment banned gillnets and large nets from bay, sounds, estuaries and other inshore waters.~~

Shark Bottom Longline Fishery

The shark bottom longline fishery has been observed since 1994, and no interactions have been reported for the Western Coastal Stock. However, 3 interactions with bottlenose dolphins ~~have been~~were recorded during 1999, 2002 and 2003 ~~. The incidents include 1 mortality (2003) and 2 hooked animals that escaped at the vessels~~ (~~1999, 2002;~~ Burgess and Morgan 2003a,b) which~~. Based on the water depths of the interactions (~12-60 m), they~~ likely involved animals from the Eastern Coastal and ~~c~~Continental ~~s~~Shelf ~~s~~Stocks. No interactions with any bottlenose dolphin stock were observed during 2004-~~2008~~2010 (Hale and Carlson 2007; Hale *et al.* 2007; Richards 2007; Hale *et al.* 2009; 2010; 2011). ~~For the shark bottom longline fishery in the Gulf of Mexico, Richards (2007) estimated bottlenose dolphin mortalities of 58 (CV=0.99), 0 and 0 for 2003, 2004 and 2005, respectively.~~

Strandings

A total of ~~526~~566 bottlenose dolphins were found stranded in Western Coastal Stock waters of the northern

Gulf of Mexico from ~~2004~~2006 through ~~2008~~2010 (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~21 September 2009 and 18 November 2009~~16 November 2011). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for 20 of these stranded dolphins. For 3 of the dolphins from 2010, visible, external oil was present on the animals.~~.~~ Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

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.

Since 1990, there have been ~~11~~12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 6 of these have occurred within the boundaries of the Western Coastal Stock and may have affected the stock. 1) 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). ~~An unusual mortality event was declared for Sarasota Bay, Florida, in 1991, but the cause was not determined.~~ 2) In March and April 1992, 111 bottlenose dolphins stranded in Texas, about 9 times the average number. The cause of this event was not determined, but carbamates were a suspected cause.

~~In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 bottlenose dolphin UMEs have been declared in the Gulf of Mexico. 1~~3) In 1993-1994 an UME of bottlenose dolphins likely 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). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. ~~2) In 1996 an UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. 3) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins). 4) In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 106 bottlenose dolphins and 1 unidentified dolphin stranded dead (NMFS 2004). Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). 5) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins (plus strandings of 1 Atlantic spotted dolphin, *S. frontalis*, and 24 unidentified dolphins). The evidence suggests the effects of a red tide bloom contributed to the cause of this event. 6) A separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins). 7~~4) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 66 bottlenose dolphins. Decomposition prevented conclusive analyses on most carcasses. ~~8~~5) During February and March of 2008 an additional event was declared in Texas involving 113 bottlenose dolphin strandings. Most of the animals recovered were in a decomposed state. The event has been closed, however, the investigation is ongoing. 6) An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 41 animals from this stock were considered to be part of the UME.

~~Table 1. Bottlenose dolphin strandings occurring in Western Coastal stock waters of the northern Gulf of Mexico from 2004 to 2008, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 21 September 2009 and 18 November 2009). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that strandings in coastal waters have been separated by coastal stock and separated from bay, sound and estuarine stocks; therefore, the annual totals below will differ from those reported previously.~~

~~Stock~~	~~Category~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	~~2008~~	~~Total~~
~~Western Coastal Stock~~	~~Total Stranded~~	~~96~~	~~88~~	~~79~~	~~112~~	~~151[a]~~	~~526~~
	~~Human Interaction~~	~~9~~	~~2~~	~~3~~	~~5~~	~~1~~	~~20~~
	~~---Fishery Interaction~~	~~1~~	~~0~~	~~2~~	~~0~~	~~1~~	~~4~~
	~~---Other~~	~~8~~	~~2~~	~~1~~	~~5~~	~~0~~	~~16~~
	~~No Human Interaction~~	~~14~~	~~29~~	~~15~~	~~27~~	~~28~~	~~113~~
	~~CBD~~	~~73~~	~~57~~	~~61~~	~~80~~	~~122~~	~~393~~

~~[a] Includes 1 mass stranding event (2 animals in August 2008)~~

Table 1. Bottlenose dolphin strandings occurring in Western Coastal Stock waters of the northern Gulf of Mexico from 2006 to 2010, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 16 November 2011). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that strandings in coastal waters have been separated by coastal stock and separated from bay, sound and estuary stocks; therefore, the annual totals below will differ from those reported previously. Finally, there were an additional 24 dolphins not included in this or any other table that stranded either in bay, sound and estuary waters or in coastal waters that could not be assigned definitively to a stock due to bad location data. If/when the location data are resolved, the numbers below could increase.

Stock	Category	2006	2007	2008	2009	2010	Total
Western Coastal Stock	Total Stranded	79	112[a]	152[b]	92	131[c]	566
	Human Interaction						
	---Yes	3	5	1	3	7	20
	---No	15	27	29	4	18	93
	---CBD	61	80	122	85	106	453

[a] This total includes 59 animals that were part of the 2007 UME
[b] This total includes 1 mass stranding event (2 animals in August 2008)
[c] This total includes 41 strandings that are part of the ongoing UME in the northern Gulf of Mexico

Other Mortality

As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. Five incidents have been documented in the Gulf of Mexico involving bottlenose dolphins and relocation trawling activities. Four of the incidents were mortalities, and 1 occurred during each of the following years: 2003, 2005, 2006, and 2007. It is likely 2 of these animals belonged to the Western Coastal ~~s~~Stock (2005, 2007) and 2 belonged to bay, sound and ~~estuarine~~estuary stocks (2003, 2006). An additional incident occurred during 2006 in which the dolphin became free during net retrieval and was observed swimming away normally. It is likely this animal belonged to a bay, sound and ~~estuarine~~estuary stock. All of the mortalities were included in the stranding database and the ~~3~~2 most recent are included in the appropriate stranding tables under "~~Other~~Yes" for Human Interaction.

The problem of dolphin depredation of fishing gear is increasing in the Gulf of Mexico. There have been 3 recent cases of fishermen illegally "taking" dolphins due to dolphin depredation of recreational and commercial fishing gear. In 2006 a charter boat fishing captain was charged under the MMPA for shooting at a dolphin that was swimming around his catch in the Gulf of Mexico, off Panama City, Florida. In 2007 a second charter fishing boat captain was fined under the MMPA for shooting at a bottlenose dolphin that was attempting to remove a fish from his line in the Gulf of Mexico, off Orange Beach, Alabama. A commercial fisherman was indicted in November 2008 for throwing pipe bombs at dolphins off Panama City, Florida, and charged in March 2009 for "taking" dolphins with an explosive device.

Feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and south of Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011~~, in press~~), and also in Texas near Corpus Christi (Bryant 1994). 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, a high rate of uncontrolled provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004), and provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells 2011~~, in press~~). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, an estimated 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011~~, in press~~). Swimming with wild bottlenose dolphins has also been documented. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

~~The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs 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 16-46μg/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), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). 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 one 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.~~

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

The nearshore habitat occupied by the 3 coastal stocks is adjacent to areas of high human population and in some areas, such as Tampa Bay, Florida, Galveston, Texas, and Mobile, Alabama, is highly industrialized. Concentrations of anthropogenic chemicals such PCBs 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 16-46µg/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), or impact reproduction through increased first-born calf mortality (Wells *et al.* 2005). 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 one 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.

STATUS OF STOCK

The status of the Western Coastal sStock 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. There are insufficient data to determine population trends for this stock. Total human-caused mortality and serious injury for this stock is not known and there is insufficient information available to determine whether the total fishery-related mortality and serious injury is insignificant and approaching zero mortality and serious injury rate. NMFS considers this stock to be a strategic stock for the following reasons: the stock size is currently unknown and PBR undetermined, and there are documented cases of human-related mortality from a number of sources; there is no systematic monitoring of all fisheries that may take this stock; and an UME of unprecedented size and duration (began 1 February 2010 and is ongoing) has impacted the Western Coastal Stock area. Because the stock size is currently unknown and PBR undetermined, and because there are documented cases of human-related mortality from a number of sources, this stock is a strategic stock. Additionally, there is no systematic monitoring of all fisheries that may take this stock. 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 truncatus*): Northern Gulf of Mexico Oceanic Stock

STOCK DEFINITION AND GEOGRAPHIC RANGE

Thirty-seven stocks have been provisionally identified for northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) bottlenose dolphins (Waring *et al.* 2001). Northern Gulf of Mexico inshore habitat has been separated into 32 bay, sound and estuarine stocks. Three northern Gulf of Mexico coastal stocks include nearshore waters from the shore to the 20m isobath. The northern Gulf of Mexico ~~c~~Continental ~~s~~Shelf ~~s~~Stock encompasses waters from 20 to 200m deep. The northern Gulf of Mexico ~~o~~Oceanic ~~s~~Stock encompasses the waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ; Figure 1).

Both "coastal~~/nearshore~~" and "offshore" ecotypes of bottlenose dolphins (Mead and Potter 1995) occur in the Gulf of Mexico (~~LeDuc and Curry 1996~~Vollmer 2011), but the distribution of each is not known. The offshore and ~~nearshore~~coastal ecotypes are genetically distinct based on both mitochondrial and nuclear markers (Hoelzel *et al.* 1998; Vollmer 2011). 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. The continental shelf is much wider in the Gulf of Mexico and these results may not apply. Ongoing research is aimed at better defining ~~these~~stock boundaries in coastal, continental shelf and oceanic waters of the Gulf of Mexico. Although the boundaries are not certain, the Oceanic Stock as currently defined is thought to be composed entirely of bottlenose dolphins of the offshore ecotype.

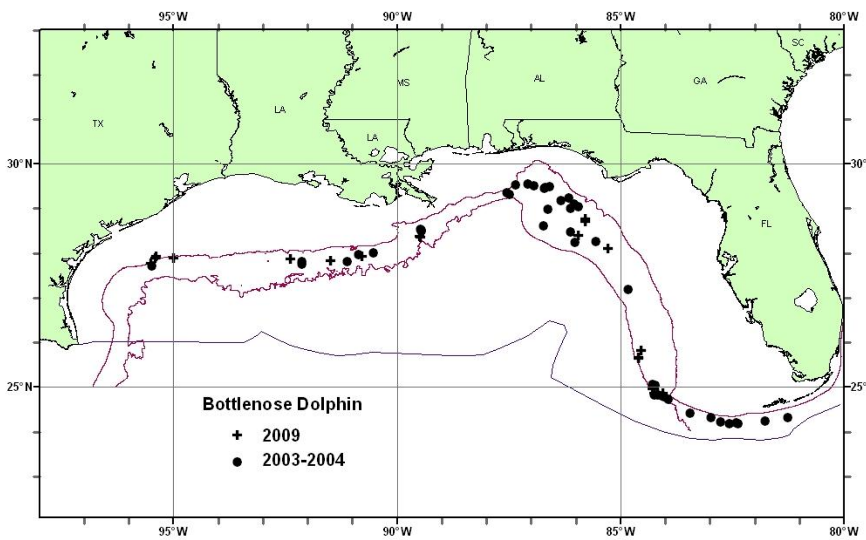

Figure 1. *Distribution of bottlenose dolphin sightings from SEFSC shipboard surveys during summer 2003 and spring 2004, and during summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), bottlenose dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.

~~Based on research currently being conducted on bottlenose dolphins in the northern 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 40 years (e.g., Wells 1994; Wells 2009) are beginning to shed light on stock structures of bottlenose dolphins, although additional analyses are needed before stock structures can be elaborated on in the northern Gulf of Mexico. As research is completed, it may be necessary to revise stocks of bottlenose dolphins in the northern Gulf of Mexico.~~

The northern Gulf of Mexico ~~o~~Oceanic ~~s~~Stock of bottlenose dolphins is provisionally being considered separate from the Atlantic Ocean stocks of bottlenose dolphins for management purposes. One line of evidence to support this decision comes from Baron *et al.* (2008), who found that Gulf of Mexico bottlenose dolphin whistles (collected from oceanic waters) were significantly different from those in the western North Atlantic Ocean (collected from continental shelf and oceanic waters) in duration, number of inflection points and number of steps.

POPULATION SIZE

The best abundance estimate available for the northern Gulf of Mexico ~~o~~Oceanic ~~s~~Stock of bottlenose dolphins is 5,806~~3,708~~ (CV=0.39~~0.42) (Mullin 2007~~; Table 1). This estimate is ~~pooled~~ from a summer 2009~~2003 and spring 2004~~ oceanic survey~~s~~ covering waters from the 200m isobath to the seaward extent of the U.S. EEZ.

Earlier abundance estimates

All ~~E~~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~~line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

~~Surveys were conducted in conjunction with bluefin tuna ichthyoplankton surveys during spring f~~From 1996 to 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline~~in oceanic waters of the northern Gulf of Mexico. Tracklines, which were perpendicular to the bathymetry, covered the waters from 200m to the offshore extent of the U.S. EEZ~~. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of bottlenose dolphins for all surveys combined was estimated. ~~was pooled across all years to develop an average abundance estimate. The estimate of abundance for bottlenose dolphins in oceanic waters, pooled from~~ For 1996 to 2001, the estimate was 2,239 (CV=0.41) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for bottlenose dolphins, pooled from 2003 to 2004, was 3,708 (CV=0.42) (Mullin 2007; Table 1).

Recent survey~~s~~ and abundance estimate~~s~~

~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because the data for estimates prior to 2003 were older than this 8-year limit, estimates from the 2003 and 2004 surveys were used. The estimate of abundance for bottlenose dolphins in oceanic waters, pooled from 2003 to 2004, was 3,708 (CV=0.42) (Mullin 2007; Table 1), which is the best available abundance estimate for this stock in the northern Gulf of Mexico.~~ During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico ~~using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for bottlenose dolphins in oceanic waters during 2009 was 5,806 (CV=0.39; Table 1).

Table 1. Summary of abundance estimates for the northern Gulf of Mexico oceanic stock of bottlenose 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
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	2,239	0.41
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	3,708	0.42
Jun-Aug 2009	Oceanic waters	5,806	0.39

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

5,806~~3,708~~ (CV=0.39~~0.42; Mullin 2007~~). The minimum population estimate for the northern Gulf of Mexico oceanic stock is 4,230~~2,641~~ bottlenose dolphins.

Current Population Trend

Three point estimates of oceanic bottlenose dolphin abundance have been made based on data from surveys covering 1996-2009. The estimates vary by a maximum factor of more than two. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of oceanic bottlenose dolphin abundance. ~~There are insufficient data to determine the population trends for this stock. The pooled abundance estimate for 2003 to 2004 of 3,708 (CV=0.42) and that for 1996-2001 of 2,239 (CV=0.41) are not significantly different (P>0.05), but due to the imprecision of the estimates, the power to detect a difference is low. These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of bottlenose dolphin abundance and stock structure. The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 4,230~~2,641~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~“recovery”~~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 42~~26~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury to this stock during ~~2005-2009~~2006-2010 was 0.6 bottlenose dolphins (CV=1.0; Table 2).

Fisheries Information

The commercial fisheries which potentially could interact with this stock in the Gulf of Mexico are the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery and the Gulf of Mexico butterfish trawl fishery (Appendix III). 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.

Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. One bottlenose dolphin serious injury was observed in the pelagic longline fishery in 1998, and estimated serious injuries attributable to the pelagic longline fishery in the Gulf of Mexico region during quarter 1 of that year were 22 (CV=1.00; Yeung 1999). There were no reports of mortality or serious injury to bottlenose dolphins by this fishery in the northern Gulf of Mexico during 1999-2008 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009). However, during 2009, 1 serious injury of a bottlenose dolphin was observed during the second quarter and estimated serious injuries attributable to the pelagic longline fishery in the Gulf of Mexico region during quarter 2 were 3.1 (CV=1.00; Garrison and Stokes 2010). The total estimated serious injury for 2009 was 3.1 animals (CV=1.0). During 2010, 1 serious injury was observed in the second quarter during experimental fishing to test the effectiveness of "weak" hooks as a potential bycatch mitigation tool. There was 100% observer coverage of all experimental sets, and the experimental fishing is not included in extrapolated bycatch estimates because it is not representative of the normal fishing effort (Garrison and Stokes 2011). The annual average serious injury and mortality attributable to the Gulf of Mexico pelagic longline fishery for the 5-year period from ~~2005~~2006 to ~~2009~~2010 was 0.6 animals (CV=1.0; Table 2). During 2007, 1 bottlenose dolphin was observed entangled and released alive in the northern Gulf of Mexico. All gear was removed and the animal was presumed to have no serious injuries. ~~All of these interactions with the pelagic longline fishery could have included bottlenose dolphins from either the continental shelf and/or oceanic stocks.~~

A trawl fishery for butterfish was monitored by NMFS observers for a short period in the 1980's 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.

~~Table 2. Summary of the incidental mortality and serious injury of Gulf of Mexico bottlenose dolphins in the Pelagic Longline fishery including the years sampled (Years), 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~~	~~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~~	~~05-09~~	~~Obs. Data Logbook~~	~~.07, .08, .15, .25, .21~~	~~0, 0, 0, 0, 1~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 0, 3~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 0, 3~~	~~NA, NA, NA, NA, 1.0~~	~~0.6 (1.0)~~

~~a Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).~~

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico oceanic bottlenose dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels[a]	Data Type[b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	06-10	47, 55, 53, 47, 46	Obs. Data Logbook	.08, .14, .25, .21, .26	0,0,0,1,0	0,0,0,0,0	0,0,0,3.2,0	0,0,0,0,0	0,0,0,3.2,0	NA, NA, NA,1.0, NA	0.6 (1.0)
TOTAL											0.6 (1.0)

a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.

Other Mortality

A total of ~~1,274~~1,340 bottlenose dolphins were found stranded in the northern Gulf of Mexico from ~~2005~~2006 through ~~2009~~2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~17~~16 November 2011~~2010~~). Of these, ~~88~~114 showed evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds). The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins belonged to the continental shelf or oceanic stocks and that they were among those strandings with evidence of human interactions. (Strandings do occur for other cetacean species whose primary range in the Gulf of Mexico is outer continental shelf or oceanic waters.)

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 221 bottlenose dolphins were considered to be part of the UME. The vast majority of stranded bottlenose dolphins are assumed to belong to one of the coastal stocks or to bay, sound and estuary stocks. Nevertheless, it is possible that some of the stranded bottlenose dolphins considered part of the UME belonged to the continental shelf or oceanic stocks.

~~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 associated with these activities (NMFS unpublished data).~~

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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 associated with these activities (NMFS unpublished data).

STATUS OF STOCK

The status of bottlenose dolphins, relative to OSP, in the northern 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 stock. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 32 bay, sound and estuary stocks of bottlenose dolphins that are included in this report. Until this effort is completed and this report is replaced by 32 individual reports, basic information for all individual bay, sound and estuary stocks will remain in this report: "Northern Gulf of Mexico Bay, Sound and Estuary Stocks". _(x)__ stocks are assessed in this report.

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins are distributed throughout the bays, sound 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 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 32 areas of contiguous, enclosed or semi-enclosed bodies of water adjacent to the northern Gulf of Mexico (i.e., U.S. 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 (>50% of associations) than with dolphins in adjacent waters. The term, as adapted from Wells *et al.* (1987) and applied in part by Urian *et al.* (2009), 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, multi-generational 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 if it were 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; F. Townsend, unpublished data), Tampa Bay (Wells 1986a; Wells *et al.* 1996b; Urian *et al.* 2009), Sarasota Bay (Irvine and Wells 1972; Irvine *et al.* 1981; Wells 1986a; Wells *et al.* 1987; Scott *et al.* 1990; Wells 1991; 2003), Lemon Bay (Wells *et al.* 1996a) and Charlotte Harbor/Pine Island Sound (Shane 1990; Wells *et al.* 1996a; Wells *et al.* 1997; Shane 2004). In Louisiana, Miller (2003) 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; Lynn and Würsig 2002; Fazioli *et al.* 2006). 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 *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, and the coastal Gulf of Mexico (1 – 12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the separate identification of bay, sound and estuary populations~~communities~~ from those occurring 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; 2003). A span of at least 5 generations of identifiable residents currently inhabits the region, including some 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.* 2005). 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 travelling between regions have been reported, with patterns ranging from travelling through adjacent communities (Wells 1986b; Wells *et al.* 1996a; 1996b) to movements over distances of several hundred km in Texas waters (Gruber 1981; Lynn and Würsig 2002). In many areas year-round residents co-occur with non-resident dolphins, providing potential opportunities for genetic exchange. About 14-17% of group sightings involving resident Sarasota Bay dolphins include at least 1 non-resident as well (Wells *et al.* 1987; Fazioli *et al.* 2006). Similar mixing of inshore residents and non-residents has been seen off San Luis Pass, Texas (Maze and Würsig 1999), the Cedar Keys, Florida (Quintana-Rizzo and Wells 2001), 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 and Würsig 2002) 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).

Spring and fall increases in abundance have been reported for St. Joseph Bay, Florida, where recent mark-recapture photo-identification surveys and 2 NOAA-sponsored health assessments were conducted during 2005-2006. Mark-recapture abundance estimates were highest in spring and fall and lowest in summer and winter (Table 1; Balmer *et al.* 2008). Individuals with low site-fidelity indices were sighted more often in spring and fall, whereas individuals sighted during summer and winter displayed higher site-fidelity indices. In conjunction with health assessments, 23 dolphins were radio tagged during April 2005 and July 2006. Dolphins tagged in spring 2005 displayed variable utilization areas and variable site fidelity patterns. In contrast, during summer 2006 the majority of radio tagged individuals displayed similar utilization areas and moderate to high site-fidelity patterns. The results of the studies suggest that during summer and winter St. Joseph Bay hosts dolphins that spend most of their time within this region, and these may represent a resident community. In spring and fall, St. Joseph Bay is visited by dolphins that range outside of this area (Balmer *et al.* 2008).

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. As information becomes available, combination or division of these provisional stocks may be warranted. For example, unpublished research suggests that Block B-21, Lemon Bay, can be subsumed under Charlotte Harbor, and B36, Caloosahatchee River, can be considered a part of Pine Island Sound. Additionally, 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 remains undetermined (Shane 1977; Gruber 1981; Wells *et al.* 1996a; 1996b; 1997; Lynn and Würsig 2002; Urian 2002). For Tampa Bay, Urian *et al.* (2009) recently described fine-scale population structuring into 5 discrete communities (including the adjacent Sarasota Bay community) that differed in their social interactions and ranging patterns. Structure was found despite a lack of physiographic barriers to movement within this large, open embayment. Urian *et al.* (2009) further suggested that fine-scale structure may be a common element among populations of bottlenose dolphins in the southeast U.S. and recommended that management should account for fine-scale structure that exists within current stock designations.

Understanding the full complement of the stock complex using the bay, sound and estuary waters of the Gulf of Mexico will require much additional information. The development of biologically-based criteria to better define and mange 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 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 north central Gulf, in addition to the ongoing studies in Texas and Florida.

Table 1. Most recent bottlenose dolphin abundance (N_{BEST}), coefficient of variation (CV) and minimum population estimate (N_{MIN}) in northern Gulf of Mexico bays, sounds and estuaries. Because they are based on data collected more than 8 years ago, most estimates are considered unknown or undetermined for management purposes. Blocks refer to aerial survey blocks illustrated in Figure 1. PBR – Potential Biological Removal; UNK – unknown; UND – undetermined.

Blocks	Gulf of Mexico Estuary	N_{BEST}	CV	N_{MIN}	PBR	Year	Reference
B51	Laguna Madre	80	1.57	UNK	UND	1992	A
B52	Nueces Bay, Corpus Christi Bay	58	0.61	UNK	UND	1992	A
B50	Co~~m~~pano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay	55	0.82	UNK	UND	1992	A
B54	Matagorda Bay, Tres Palacios Bay, Lavaca Bay	61	0.45	UNK	UND	1992	A
B55	West Bay	32	0.15	UNK	UND	2000	E
B56	Galveston Bay, East Bay, Trinity Bay	152	0.43	UNK	UND	1992	A
B57	Sabine Lake	0[a]	-		UND	1992	A
B58	Calcasieu Lake	0[a]	-		UND	1992	A
B59	Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay	0[a]	-		UND	1992	A
B60	Terrebonne Bay, Timbalier Bay	100	0.53	UNK	UND	1993	A

B61	Barataria Bay	138	0.08	UNK	UND	2001	D
B30	Mississippi River Delta	0[a]	-		UND	1993	A
B02-05, 29, 31	Mississippi Sound, Lake Borgne, Bay Boudreau	1,401	0.13	UNK	UND	1993	A
B06	Mobile Bay, Bonsecour Bay	122	0.34	UNK	UND	1993	A
B07	Perdido Bay	0[a]	-		UND	1993	A
B08	Pensacola Bay, East Bay	33	0.80	UNK	UND	1993	A
B09	Choctawhatchee Bay	179	0.04	173	1.7	2007	H
B10	St. Andrew Bay	124	0.57	UNK	UND	1993	A
B11	St. Joseph Bay	146	0.18	126	1.3	2005-07	F
B12-13	St. Vincent Sound, Apalachicola Bay, St. George Sound	43953 7	0.14 0.09	39049 8	3.95.0	2007-08	G
B14-15	Apalachee Bay	491	0.39	UNK	UND	1993	A
B16	Waccasassa Bay, Withlacoochee Bay, Crystal Bay	100	0.85	UNK	UND	1994	A
B17	St. Joseph Sound, Clearwater Harbor	37	1.06	UNK	UND	1994	A
B32-34	Tampa Bay	559	0.24	UNK	UND	1994	A
B20, 35	Sarasota Bay, Little Sarasota Bay	160	na[c]	160	1.6	2007	B
B21	Lemon Bay	0[a]	-		UND	1994	A
B22-23	Pine Island Sound, Charlotte Harbor, Gasparilla Sound	209	0.38	UNK	UND	1994	A
B36	Caloosahatchee River	0[a,b]	-		UND	1985	C
B24	Estero Bay	104	0.67	UNK	UND	1994	A
B25	Chokoloskee Bay, Ten Thousand Islands, Gullivan Bay	208	0.46	UNK	UND	1994	A
B27	Whitewater Bay	242	0.37	UNK	UND	1994	A
B28	Florida Keys (Bahia Honda to Key West)	29	1.00	UNK	UND	1994	A

References: A – Blaylock and Hoggard 1994; B – Wells 2009; C – Scott *et al.* 1989; D – Miller 2003; E – Irwin and Würsig 2004; F – Balmer *et al.* 2008; G – Tyson *2008et al.* 2011; H – Conn *et al.* 2011

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 N_{BEST} was a direct count of known individuals.

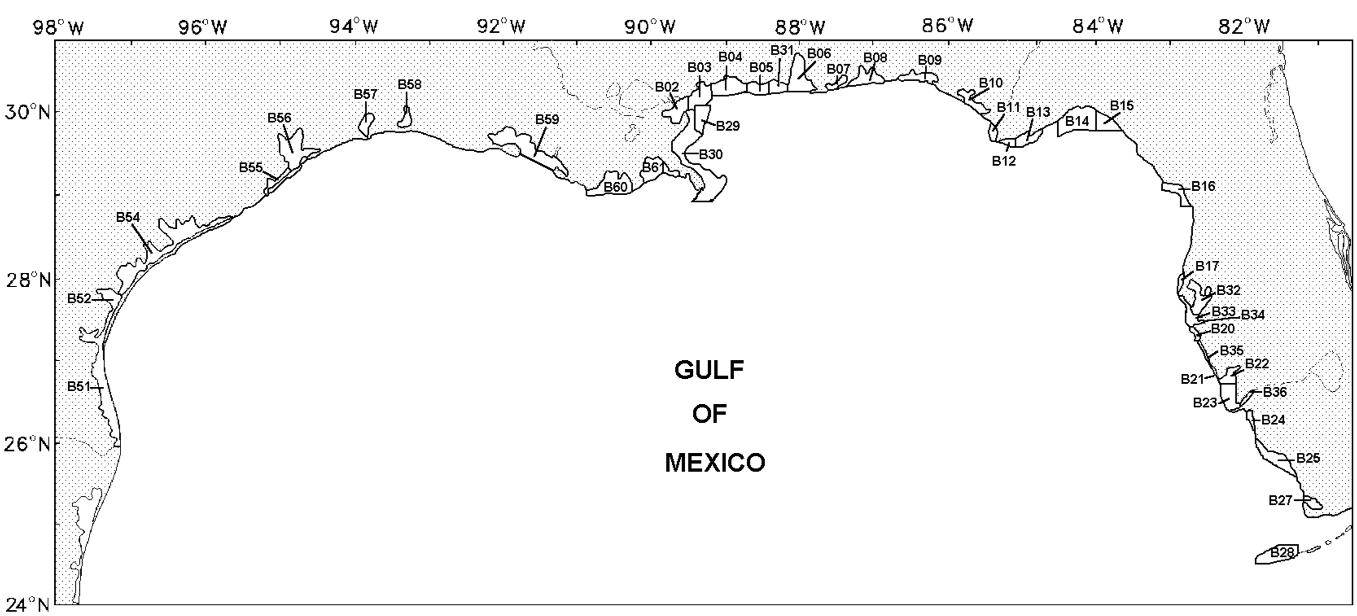

Figure 1. *Northern Gulf of Mexico bays and sounds. Each of the alpha-numerically designated blocks corresponds to ~~1~~one of the NMFS Southeast Fisheries Science Center logistical aerial survey areas listed in Table 1. The bottlenose dolphins inhabiting each bay and sound are considered to comprise 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 of these stocks is considered unknown (Wade and Angliss 1997). Recent mark-recapture population size estimates are available for Choctawhatchee Bay, St. Joseph Bay and Apalachicola Bay, Florida, and a direct count is available for Sarasota Bay, Florida (Table 1). Previous population size for most other stocks (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. Analyses are currently underway that should provide updated abundance estimates for Lemon Bay, Gasparilla Sound, Charlotte Harbor, and Pine Island Sound during 2011 (Wells, pers. comm.).

Minimum Population Estimate

The population size for all but 4 stocks is currently unknown and the minimum population estimates are given for those 4 stocks in Table 1. In most cases, 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. Eleven unusual mortality events have occurred among portions of these dolphin communities between 1990 and 2008; 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.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are not known for the dolphin communities that constitute 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 ~~b~~Biological ~~r~~Removal (PBR) is undetermined 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”~~recovery factor (Wade and Angliss 1997). The ~~“recovery”~~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

The total annual human-caused mortality and serious injury for these stocks during ~~2005~~2006-~~2009~~2010 is unknown.

Some of the bay, sound and estuary 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 1972-1989, 490 bottlenose dolphins, an average of 29 dolphins annually, were removed from a few locations in the Gulf of Mexico, including the Florida Keys, Charlotte Harbor, Tampa Bay and elsewhere. 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 1982-1988 were females. The impact of these removals on the stocks is unknown.

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 purse seine, ~~and~~ gillnet, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III).

Hook and Line Fisheries

During 2006 there were 8 mortalities for which hook and line gear entanglement or ingestion were documented in the stranding database, and attempts were made to disentangle 2 live animals from hook and line gear. During 2007, there were 4 mortalities, and during 2008, 2 mortalities, for which hook and line gear entanglement or ingestion were documented. During 2009, there were 2 mortalities for which hook and line gear entanglement or ingestion were documented, and attempts were made to disentangle 2 live animals from hook and line gear. Finally, during 2010, there were 3 mortalities for which hook and line gear entanglement or ingestion were documented, and an attempt was made to disentangle 1 live animal from hook and line gear. In total, during 2006-2010, for 19 mortalities for which hook and line gear entanglement were documented, 14 occurred in Florida, 4 in Texas and 1 in Mississippi; and for 5 attempted disentanglements from hook and line gear, 3 occurred in Texas and 2 in Florida. The mortalities and live entanglements were included in the stranding database (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011) and are included in the stranding totals presented in Table 1.

Shrimp Trawl Fishery

~~Historically, there have been very low numbers of incidental mortality or injury in the stocks associated with the shrimp trawl fishery.~~ A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. ~~Three~~Four bottlenose dolphin mortalities were observed in the shrimp trawl fishery~~.~~ during 2003, 2007, 2008 and 2010. The 2007 mortality occurred off the Louisiana coast and could have belonged to the Western Coastal Stock or a bay, sound and estuary stock (Vermilion Bay, West Cote Blanche Bay, Atchafalaya Bay Stock or Terrebonne Bay, Timbalier Bay Stock). The 2003 mortality occurred off the coast of Alabama and could have belonged to the Northern Coastal Stock or a bay, sound and estuary stock (Mobile Bay, Bonsecour Bay Stock or Mississippi Sound, Lake Borgne, Bay Boudreau Stock). ~~One mortality occurred in 2008 off the coast of Texas in the vicinity of Laguna Madre, 1 mortality occurred in 2007 off the coast of Louisiana in the vicinity of Atchafalaya Bay, and 1 mortality occurred in 2003 off the coast of Alabama near Mobile Bay. The Texas 2008 mortality could have belonged to the bottlenose dolphin Western Coastal Stock or Continental Shelf Stock. The Louisiana 2007 mortality could have belonged to the Western Coastal Stock or a bay, sound and estuary stock. The Alabama 2003 mortality could have belonged to the Northern Coastal Stock or a bay, sound and estuary stock.~~

Blue and Stone Crab Trap/Pot Fisheries

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. In 2010, a calf likely belonging to the Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu

Santo Bay Stock was disentangled by stranding network personnel from a crab trap line wrapped around its peduncle. The animal swam away with no obvious injuries. In 2008 there was a report of a live dolphin in the Caloosahatchee River in Florida entangled in pot line without a buoy attached. This animal was likely a member of the Caloosahatchee River Stock (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011). In 2002 there was a calf stranded near Clearwater, Florida, with blue crab trap line wrapped around its rostrum, through its mouth and looped around its tail~~.~~ ~~There was an additional unconfirmed report to the stranding network in 2002 of a dolphin entangled in a stone crab trap with the buoy still attached. The animal was reportedly cut loose from the trap and slowly swam off with the line and buoy still wrapped around it~~ (NMFS unpublished data). This animal was likely a member of the St. Joseph Sound, Clearwater Harbor Stock. ~~In 2008 there was a report of a live dolphin in the Caloosahatchee River in Florida entangled in pot line without a buoy attached. This animal was likely a member of the Caloosahatchee River Stock (a bay, sound and estuary stock). In 2008, a dolphin likely belonging to the Western Coastal Stock was disentangled from crab trap gear in Texas from a concerned citizen and swam away with no reported injuries. Also in 2008, another dolphin off Florida likely belonging to the Eastern Coastal Stock, reportedly half the size of an adult, was disentangled by a county marine officer from a crab pot line and swam away with no reported injuries (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 17 November 2010).~~ Since there is no systematic observer program, it is not possible to estimate the total number of interactions or mortalities associated with crab traps/pots.

Menhaden Purse Seine Fishery

~~There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). Through the Marine Mammal Authorization Program, there have been 11 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuary waters by the menhaden purse seine fishery: 2 takes of single bottlenose dolphins were reported in Louisiana waters during 2005 (1 of the animals may have been dead prior to capture); 1 take of a single bottlenose dolphin was reported in Louisiana waters during 2004; 2 takes of single unidentified dolphins were reported during 2002 (1 in Mississippi and 1 in Louisiana waters); 1 take of a single bottlenose dolphin was reported in Louisiana waters during 2001; and 3 takes were reported in 2000, 2 of which were for single dolphins (1 bottlenose, 1 unidentified) in Louisiana waters and the third was for 3 bottlenose dolphins in a single purse seine in Mississippi waters. The menhaden purse seine 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 when 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.~~ There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). Through the Marine Mammal Authorization Program, there have been 11 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery. These takes likely affected the following stocks: Western Coastal Stock; Northern Coastal Stock; Mississippi Sound, Lake Borgne, Bay Boudreau Stock; Mississippi River Delta Stock; and Barataria Bay Estuarine System Stock. One take of a single bottlenose dolphin was reported in Louisiana waters during 2004 (likely belonged to the Mississippi River Delta Stock). Two takes of single unidentified dolphins were reported during 2002 (1 in Mississippi and 1 in Louisiana waters; likely belonged to Mississippi Sound, Lake Borgne, Bay Boudreau Stock and Barataria Bay Estuarine System Stock). One take of a single bottlenose dolphin was reported in Louisiana waters during 2001 (likely belonged to Mississippi River Delta Stock or Northern Coastal Stock). Three takes were reported in 2000, 2 of which were for single dolphins (1 bottlenose, 1 unidentified) in Louisiana waters (likely belonged to Western Coastal Stock and either Mississippi River Delta Stock or Northern Coastal Stock), and the third was for 3 bottlenose dolphins in a single purse seine in Mississippi waters (likely belonged to Mississippi Sound, Lake Borgne, Bay Boudreau Stock). The menhaden purse seine 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.

Gillnet Fishery

No marine mammal mortalities associated with gillnet fisheries have been reported in recent years, but stranding data suggest that gillnet and marine mammal interactions do occur, causing mortality and serious injury. Four research-related gillnet mortalities occurred between 2003 and 2007 in Texas and Louisiana and an additional research gillnet entanglement occurred during 2008 in Texas (see "Other Mortality" below for details). All of the research-related interactions were likely with animals belonging to the following bay, sound and estuary stocks: Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock (2 mortalities); Mississippi River Delta Stock (1 mortality); and Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock (1 mortality, 1 released alive). In 1995, a Florida state constitutional amendment banned gillnets and large nets from bays, sounds, estuaries and other inshore waters.

Strandings

A total of ~~559~~554 bottlenose dolphins were found stranded in bays, sounds and estuaries of the northern Gulf of Mexico from ~~2005~~2006 through ~~2009~~2010 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~17~~16 November ~~2010~~2011). Evidence of human interactions (e.g., gear entanglement, mutilation, gunshot wounds) was detected for ~~63~~75 of these dolphins. For 3 of the dolphins from 2010, visible, external oil was present on the animals. Bottlenose dolphins are known to become entangled in, or ingest recreational and commercial fishing gear (Wells and Scott 1994; Gorzelany 1998; Wells *et al.* 1998; Wells *et al.* 2008), and some are struck by vessels (Wells and Scott 1997; Wells *et al.* 2008).

There are a number of difficulties associated with the interpretation of stranding data. Except in rare cases, such as Sarasota Bay, Florida, where residency can be determined, 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.

Since 1990, there have been ~~11~~12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico. 1) 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 number of 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). 2) An unusual mortality event was declared for Sarasota Bay, Florida, in 1991, but the cause was not determined. 3) In March and April 1992, 111 bottlenose dolphins stranded in Texas - about 9 times the average number. The cause of this event was not determined, but carbamates were a suspected cause.

~~In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was formalized to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 bottlenose dolphin UMEs have been declared in the Gulf of Mexico. 1~~4) In 1993-1994 an UME of bottlenose dolphins likely 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). From February through April 1994, 220 bottlenose dolphins were found dead on Texas beaches, of which 67 occurred in a single 10-day period. ~~2~~5) In 1996 an UME was declared for bottlenose dolphins in Mississippi when 27 bottlenose dolphins stranded during November and December. The cause was not determined, but a *Karenia brevis* (red tide) bloom was suspected to be responsible. ~~3~~6) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle (additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins. ~~4~~7) In March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 105 bottlenose dolphins and 2 unidentified dolphins stranded dead (NMFS 2004). Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). ~~5~~8) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins (plus strandings of 1 Atlantic spotted dolphin, *S. frontalis*, and 24 unidentified dolphins). The evidence suggests the effects of a red tide bloom contributed to the cause of this event. ~~6~~9) A separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins). ~~7~~10) During February and March of 2007 an event was declared for northeast Texas and western Louisiana involving 66 bottlenose dolphins. Decomposition prevented conclusive analyses on most carcasses. ~~8~~11) During February and March of 2008 an additional event was declared in Texas involving 113 bottlenose dolphin strandings. Most of the animals recovered were in a decomposed state. The investigation is closed and a direct cause could not be identified. However, there were numerous, co-occurring harmful algal bloom toxins detected during the time period of this UME which may have contributed to the mortalities (Fire *et al.*, in press). 12) An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 144 animals from bay, sound and estuary stocks were considered to be part of the UME.

~~Table 2. Bottlenose dolphin strandings occurring in bays, sounds and estuaries in the northern Gulf of Mexico from 2005 to 2009, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 17 November 2010). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that this table does include strandings from Barataria Bay Estuarine System, Choctawhatchee Bay and St. Joseph Bay Stocks. Finally, there were an additional 27 dolphins not included in this table that stranded either in bay, sound and estuary waters or in coastal waters that could not be assigned definitively to a stock due to bad location data. If/when the location data are resolved, the numbers below could increase.~~

~~Stock~~	~~Category~~	~~2005~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~Total~~
~~Bay, Sound and Estuary~~	~~Total Stranded~~	~~140~~	~~165[a]~~	~~77~~	~~78~~	~~99[b]~~	~~559~~
	~~Human Interaction~~						
	~~---Yes~~	~~4~~	~~23~~	~~10~~	~~8~~	~~18~~	~~63~~
	~~---No~~	~~31~~	~~36~~	~~15~~	~~17~~	~~10~~	~~109~~
	~~---CBD~~	~~105~~	~~106~~	~~52~~	~~53~~	~~71~~	~~387~~

~~[a] Includes 2 mass stranding events in Florida (2 animals in July 2006, 3 animals in November 2006)~~
~~[b] Includes a mass stranding of 6 animals in Louisiana in June 2009~~

Table 2. Bottlenose dolphin strandings occurring in bays, sounds and estuaries in the northern Gulf of Mexico from 2006 to 2010, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 16 November 2011). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that this table does not include strandings from Barataria Bay Estuarine System, Choctawhatchee Bay or St. Joseph Bay Stocks. Finally, there were an additional 24 dolphins not included in this or any other table that stranded either in bay, sound and estuary waters or in coastal waters that could not be assigned definitively to a stock due to bad location data. If/when the location data are resolved, the numbers below could increase.

Stock	**Category**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Bay, Sound and Estuary	Total Stranded	125[a,b]	68[c]	69[d]	98[e]	194[f]	554
	Human Interaction						

---Yes	22	10	5	18	20	75
---No	29	11	15	9	10	74
---CBD	74	47	49	71	164	405

[a] This total includes 2 mass stranding events in Florida (2 animals in July 2006, 3 animals in November 2006)
[b] This total includes 75 animals that were part of 2 different UMEs in Florida
[c] This total includes 4 animals that were part of an UME in Texas
[d] This total includes 3 animals that were part of an UME in Texas
[e] This total includes a mass stranding of 6 animals in Louisiana in June 2009
[f] This total includes 144 animals that are part of the ongoing UME in the northern Gulf of Mexico

Other Mortality

Two dolphin research-related mortalities have occurred. During November 2002 in Sarasota Bay, Florida, a 35-year-old male died in a health assessment research project. The histopathology report stated that drowning was the cause of death. However, the necropsy revealed that the animal was in poor condition as follows: anemic, thin (ribs evident, blubber thin and grossly lacking lipid), no food in the stomach and little evidence of recent feeding in the digestive tract, vertebral fractures with muscle atrophy, with additional conditions present. This has been the only such loss during capture/release research conducted over a ~~40~~41-year period on Florida's central west coast. Another research-related mortality occurred during July 2006 in St. Joseph Bay, in the Florida Panhandle, during a NMFS health assessment research project to investigate a series of ~~Unusual Mortality Events~~UMEs in the region. The animal became entangled deep in the capture net and was found dead during extrication of other animals from the net. The cause of death was determined to be asphyxiation.

During 2009 in Mobile Bay, Alabama, near the entrance to the Gulf of Mexico, a bottlenose dolphin mortality resulted from an entanglement in the lazy line of a trawl net during an educational trawling cruise operated by a marine science education and research laboratory. This animal likely belonged to the Mobile Bay and Bonsecour Bay Stock of bay, sound and estuary bottlenose dolphins.

As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. Five incidents have been documented in the Gulf of Mexico involving bottlenose dolphins and relocation trawling activities. Four of the incidents were mortalities, and 1 occurred during each of the following years: 2003, 2005, 2006 and 2007. It is likely that ~~two~~2 of these animals belonged to the Western Coastal Stock (2005, 2007) and 2 animals belonged to bay, sound and estuary stocks (2003, 2006). An additional incident occurred during 2006 in which the dolphin became free during net retrieval and was observed swimming away normally. It is likely this animal belonged to a bay, sound and estuary stock. All of the mortalities were included in the stranding database and the ~~3~~2 most recent are included in the appropriate stranding tables under "Yes" for Human Interaction.

Four mortalities resulted from gillnet entanglements in research gear off Texas and Louisiana during 2003, 2004, 2006 and 2007. Three of the mortalities were a result of fisheries sampling and research in Texas, and 1 mortality (2006) occurred during a gulf sturgeon research project in Louisiana. Additionally, in 2008, 1 dolphin was entangled in a fisheries research gillnet in Texas. The floatline was wrapped around the dolphin's tail; the net released itself upon retrieval and the dolphin appeared in good condition as it swam away. All of these animals likely belonged to the following bay, sound and estuary stocks: Copano Bay, Aransas Bay, San Antonio Bay, Redfish Bay, Espiritu Santo Bay Stock (2003, 2004 mortalities); Mississippi River Delta Stock (2006 mortality); and Matagorda Bay, Tres Palacios Bay, Lavaca Bay Stock (2007 mortality, 2008 released alive). ~~bay, sound and estuary stocks.~~ The mortalities were included in the stranding database and the 2 most recent are included in Table 2 under "Yes" for Human Interaction.

The problem of dolphin depredation of fishing gear is increasing in Gulf of Mexico coastal and estuary waters. There have been 3 recent cases of fishermen illegally "taking" dolphins due to dolphin depredation of recreational and commercial fishing gear. In 2006 a charter boat fishing captain was charged under the MMPA for shooting at a dolphin that was swimming around his catch in the Gulf of Mexico, off Panama City, Florida. In 2007 a second charter fishing boat captain was fined under the MMPA for shooting at a bottlenose dolphin that was attempting to remove a fish from his line in the Gulf of Mexico, off Orange Beach, Alabama. A commercial fisherman was indicted in November 2008 for throwing pipe bombs at dolphins off Panama City, Florida, and charged in March 2009 for "taking" dolphins with an explosive device.

Illegal feeding or provisioning of wild bottlenose dolphins has been documented in Florida, particularly near Panama City Beach in the Panhandle (Samuels and Bejder 2004) and in and near Sarasota Bay (Cunningham-Smith *et al.* 2006; Powell and Wells 2011), and also in Texas near Corpus Christi (Bryant 1994). 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, a high rate of uncontrolled provisioning was observed near Panama City Beach in 1998 (Samuels and Bejder 2004), and provisioning has been observed south of Sarasota Bay since 1990 (Cunningham-Smith *et al.* 2006; Powell and Wells 2011). There are emerging questions regarding potential linkages between provisioning and depredation of recreational fishing gear and associated entanglement and ingestion of gear, which is increasing through much of Florida. During 2006, at least 2% of the long-term resident dolphins of Sarasota Bay died from ingestion of recreational fishing gear (Powell and Wells 2011). Swimming with wild bottlenose dolphins has also been documented. Near Panama City Beach, Samuels and Bejder (2004) concluded that dolphins were amenable to swimmers due to illegal provisioning. Swimming with wild dolphins may cause harassment, and harassment is illegal under the MMPA.

As noted previously, bottlenose dolphins are known to be struck by vessels (Wells and Scott 1997). During ~~2005-2009~~2006-2010, ~~11~~12 stranded bottlenose dolphins (of ~~559~~550 total strandings) showed signs of a boat collision (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~17~~16 November ~~2010~~2011). It is possible some of the instances were post-mortem collisions. In addition to vessel collisions, the presence of vessels may also impact bottlenose dolphin behavior in bays, sounds and estuaries. Nowacek *et al.* (2001) reported that boats pass within 100m of each bottlenose dolphin in Sarasota Bay once every 6 minutes on average, leading to changes in dive patterns and group cohesion. Buckstaff (2004) noted changes in communication patterns of Sarasota Bay dolphins when boats approached. Miller *et al.* (2008) investigated the immediate responses of bottlenose dolphins to "high-speed personal watercraft" (i.e., boats) in Mississippi Sound. They found an immediate impact on dolphin behavior demonstrated by an increase in traveling behavior and dive duration, and a decrease in feeding behavior for non-traveling groups. The findings suggested dolphins attempted to avoid high-speed personal watercraft. It is unclear whether repeated short-term effects will result in long-term consequences like reduced health and viability of dolphins. Further studies are needed to determine the impacts throughout the Gulf of Mexico.

~~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.~~

~~Analyses of organochlorine concentrations in the tissues of bottlenose dolphins in Sarasota Bay, Florida, have found that the concentrations found in male dolphins exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring, and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on estuary dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.~~

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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.

Analyses of organochlorine concentrations in the tissues of bottlenose dolphins in Sarasota Bay, Florida, have found that the concentrations found in male dolphins exceeded toxic threshold values that may result in adverse effects on health or reproductive rates (Schwacke *et al.* 2002). Studies of contaminant concentrations relative to life history parameters showed higher levels of mortality in first-born offspring, and higher contaminant concentrations in these calves and in primiparous females (Wells *et al.* 2005). While there are no direct measurements of adverse effects of pollutants on estuary dolphins, the exposure to environmental pollutants and subsequent effects on population health is an area of concern and active research.

STATUS OF STOCKS

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 ~~11~~12 unusual mortality events among bottlenose dolphins along the northern 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, in large part because it has not been possible to assign mortalities to specific stocks due to a lack of empirical information on stock identification.

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 fishery-related mortality and serious injury exceeds 10% of the total known PBR or previous PBR, and therefore, it is probably not insignificant and not approaching the zero mortality and serious injury rate. NMFS considers each of these stocks to be strategic ~~B~~because most of the stock sizes are currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, ~~NMFS considers that each of these stocks is a strategic stock~~and because stock areas in Louisiana, Mississippi, Alabama and the western Florida panhandle have been impacted by an UME of unprecedented size and duration (began 1 February 2010 and is ongoing).

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BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Barataria Bay Estuarine System Stock

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 32 bay, sound and estuary stocks of bottlenose dolphins in the Gulf of Mexico. Until this effort is completed and 32 individual reports are available, some of the basic information presented in this report will also be included in the report: "Northern Gulf of Mexico Bay, Sound and Estuary Stocks".

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009). In many cases, residents predominantly use the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Shane 1990; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006). ~~These e~~Early studies indicating year-round residency to bays in both the eastern and western Gulf of Mexico led to the delineation of 33 bay, sound and estuary stocks, including Barataria Bay, with the first stock assessment reports in 1995.

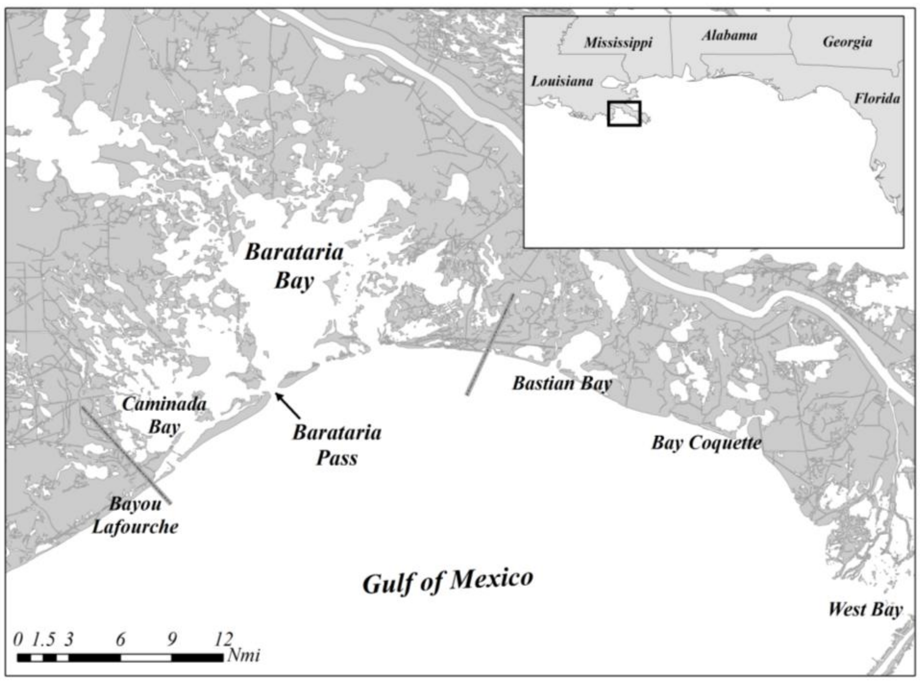

Figure 1. *Geographic extent of the Barataria Bay Estuarine System (BBES) Stock, located on the coast of Louisiana. The borders are denoted by ~~dashed~~solid lines.*

More recently, genetic data also support the concept of relatively discrete bay, sound and estuary stocks (Duffield and Wells 2002; Sellas *et al.* 2005). Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, Texas, and the coastal Gulf of Mexico (1-12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population structure among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the identification of bay, sound and estuary populations~~communities~~ distinct from those occurring in adjacent Gulf coastal waters. Differences in reproductive seasonality from site to site also suggest genetic-based distinctions among areas~~communities~~ (Urian *et al.* 1996). Photo-ID and genetic data from several inshore areas of the southeastern United States also support the existence of resident estuarine animals and a differentiation between animals biopsied along the Atlantic coast and those biopsied within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007; Rosel *et al*. 2009; NMFS unpublished).

Barataria Bay is a shallow (mean depth=2m) estuarine system located in central Louisiana. It is bounded in the west by Bayou Lafourche, in the east by the Mississippi River delta and in the south by the Grand Terre barrier islands. Barataria Bay is approximately 110km in length and 50km in width at its widest point where it opens into the Gulf of Mexico (Connor and Day 1987). This estuarine system is connected to the Gulf of Mexico by a series of passes: Caminada Pass, Barataria Pass, Pass Abel and Quatre Bayou Pass. It is fringed by a complex system of canals, bayous, small embayments and channels. Bay waters are turbid, and salinity varies widely from south to north with the more saline, tidally influenced portions in the south and lakes in the north (U.S. EPA 1999; Moretzsohn et al. 2010). Miller and Baltz (2009) reported salinity varied seasonally and averaged 22.77psu (practical salinity unit) in lower Barataria and Caminada Bays (data collected during dolphin sightings). Barataria Bay, in conjunction with the Timbalier-Terrebone Bay system, has been selected as an estuary of national significance by the Environmental Protection Agency National Estuary Program. The bay is characterized by marshes and swamp forests which supply a nursery and breeding ground for migratory birds and a variety of commercially and recreationally important species, such as finfish, shellfish, alligators, songbirds, geese and ducks (U.S. EPA 1999; Moretzsohn et al. 2010). The Barataria basin also produces a significant part of U.S. petroleum resources and is an important commercial harbor. High industrial and commercial use of the area and human alteration have resulted in environmental degradation and habitat loss. The most serious environmental issues facing the estuarine system include loss of coastal wetlands, eutrophication, barrier island erosion, saltwater intrusion and introduction of toxic substances (Connor and Day 1987; Barras et al. 2003).

The Barataria Bay Estuarine System (BBES) Stock area includes Caminada Bay and Barataria Bay (Figure 1). During June 1999 – May 2002, Miller (2003) conducted 44 boat-based, photo-ID surveys in lower Barataria and Caminada Bays. Dolphins were present year-round, and 133 individual dolphins were identified. One individual was sighted 6 times, but most individuals, 58%, were sighted only once. Using a fine-scale microhabitat approach, Miller and Baltz (2009) described foraging habitat of bottlenose dolphins in Barataria Bay. Significant differences in temperature, group size, season and turbidity differentiated foraging sites from non-foraging sites. Foraging was more often observed in waters 200-500m from shore in 4-6m depth and at salinity values of approximately 20psu. Additional study is needed to further describe the population of bottlenose dolphins inhabiting the BBES. The current stock boundary does not include any coastal waters outside of the barrier islands. Further research is needed to determine the degree to which dolphins of this stock utilize nearshore coastal waters outside Barataria Bay. This stock boundary is subject to change upon further study of dolphin residency patterns in estuarine waters of Louisiana. Information on the use of coastal waters will be important when considering exposure to coastal fisheries as estuarine animals that make use of nearshore coastal waters would be at risk of entanglement in fishing gear while moving along the coast. Ongoing NOAA photo-ID surveys initiated in 2010, as well as data from tracking of 25 bottlenose dolphins tagged with satellite-linked transmitters in and around Barataria Bay in August 2011 will address some of these issues as the data become available.

Dolphins residing in the estuaries southeast of this stock between BBES and the Mississippi River mouth (Bastian Bay, Bay Coquette and West Bay) are not currently covered in any stock assessment report. There are insufficient data to determine whether animals in this region exhibit affiliation to the BBES stock or should be delineated as their own stock. Further research is needed to establish affinities of dolphins in this region. It should be noted that in this region during 200~~5~~6-20~~09~~10, ~~1~~2 bottlenose dolphins ~~was~~were reported stranded in the Bastian Bay area. ~~No evidence of human interactions was detected~~It could not be determined if there was evidence of human interactions for these 2 strandings. Both strandings were considered to be part of the ongoing Unusual Mortality Event (see Other Mortality).

POPULATION SIZE

The total number of bottlenose dolphins residing within the BBES Stock is unknown. Miller (2003) conducted boat-based, photo-ID surveys in lower Barataria and Caminada Bays from June 1999 to May 2002. Miller (2003) identified 133 individual dolphins, and using closed-population unequal catchability models in program CAPTURE, produced an abundance estimate of 138-238 (128-297, 95% CI). Miller's (2003) estimate covers a large portion of the area covered by the BBES stock; however, these data are considered expired due to being more than 8 years old.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the BBES Stock of 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 net productivity rates are unknown for this stock. 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 the minimum population size, one-half the maximum productivity rate, and a ~~“recovery”~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the BBES stock of bottlenose dolphins 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 this stock of bottlenose dolphins is undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the BBES bottlenose dolphin stock during ~~2005-2009~~2006-2010 is unknown.

Fishery Information

The commercial fisheries which potentially could interact with this stock are the shrimp trawl, menhaden purse seine, ~~and~~ blue crab trap/pot, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III). During 2005-2009, menhaden, brown shrimp, white shrimp and blue crab fisheries were all important commercial fisheries in Barataria Bay, comprising 4 of the top 5 commercial fisheries each year, both by weight and value of landings (based on data from the Louisiana Department of Wildlife and Fisheries Trip Ticket Program, M. Harden, pers. comm.). There have been no documented interactions between BBES bottlenose dolphins and the shrimp trawl fishery, nor any documented interactions with hook and line fisheries. There have been no documented mortalities of BBES bottlenose dolphins in crab trap/pot fisheries. There is no systematic observer coverage of crab trap/pot fisheries; therefore, it is not possible to quantify total mortality.

Menhaden Purse Seine Fishery

The menhaden purse seine fishery was the top commercial fishery for Barataria Bay in terms of landings by weight for each year from 2005 to 2009 (M. Harden, pers. comm.). There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery but incidental mortality of bottlenose dolphins has been reported for this fishery (Reynolds 1985). Through the Marine Mammal Authorization Program, there have been 11 self-reported incidental takes (all mortalities) of bottlenose dolphins in northern Gulf of Mexico coastal and estuarine waters by the menhaden purse seine fishery, 1 of which occurred in Barataria Bay during 2002 and was a single “unidentified” dolphin (assumed to be a bottlenose dolphin). 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.

Other Mortality

From ~~2005~~2006 to ~~2009~~2010, ~~5~~ 25 bottlenose dolphins were reported stranded within the BBES (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~17~~16 November ~~2010~~2011). Evidence of human interactions was detected for 1 stranded dolphin, which stranded alive visibly oiled during December 2010. ~~One animal stranded during 2006 and the remaining 4 stranded during 2008. It was not possible to make any determination of possible human interaction for 3 of these strandings. For the remaining 2 dolphins, no evidence of human interaction was detected.~~ Stranding data probably underestimate the extent of ~~fishery~~human-~~related~~caused mortality and serious injury because not all of the marine mammals that die or are seriously injured in ~~fishery~~human interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other ~~fishery~~human interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interactions.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 20 stranded dolphins from this stock were considered to be part of the UME.

Table 1. Bottlenose dolphin strandings occurring in the Barataria Bay Estuarine System Stock area from 2006 to 2010, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 16 November 2011). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	**Category**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Barataria Bay Estuarine System Stock	Total Stranded	1	0	4	0	20[a]	25
	Human Interaction						
	---Yes	0	0	0	0	1	1
	---No	0	0	2	0	1	3
	---CBD	1	0	2	0	18	21

[a] All strandings from 2010 are part of the ongoing UME event in the northern Gulf of Mexico.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr et al. 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr et al. 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

STATUS OF STOCK

The status of the BBES stock 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 population trends for this stock. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. ~~Because the stock size is currently unknown but likely small, relatively few mortalities and serious injuries would exceed PBR, so~~ Because an UME of unprecedented size and duration (began 1 February 2010 and is ongoing) has impacted Barataria Bay, NMFS considers this stock to be strategic.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
Choctawhatchee Bay Stock

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 32 bay, sound and estuary stocks of bottlenose dolphins in the Gulf of Mexico. Until this effort is completed and 32 individual reports are available, some of the basic information presented in this report will also be included in the report: "Northern Gulf of Mexico Bay, Sound and Estuary Stocks".

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986a; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009). In many cases, residents predominantly use the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Shane 1990; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006). These eEarly studies indicating year-round residency to bays in both the eastern and western Gulf of Mexico led to the delineation of 33 bay, sound and estuary stocks, including Choctawhatchee Bay, with the first stock assessment reports in 1995.

More recently, genetic data also support the concept of relatively discrete bay, sound and estuary stocks (Duffield and Wells 2002; Sellas *et al.* 2005). Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, Texas, and the coastal Gulf of Mexico (1-12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population differentiation among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the identification of bay, sound and estuary communitiespopulations distinct from those occurring in adjacent Gulf coastal waters. Differences in reproductive seasonality from site to site also suggest genetic-based distinctions among

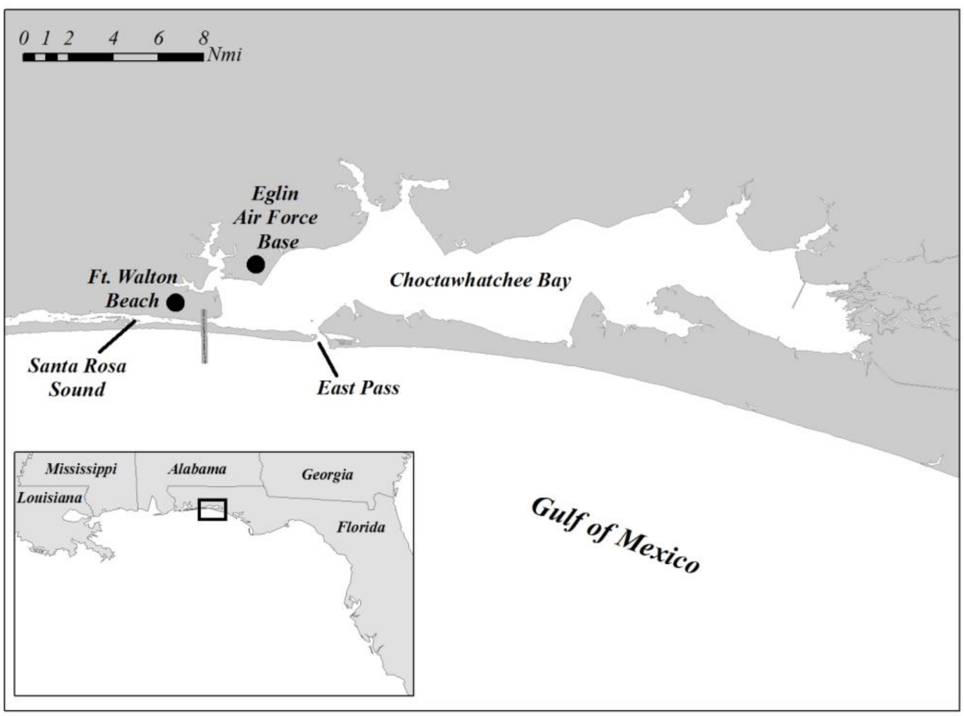

Figure 1. *Geographic extent of the Choctawhatchee Bay Stock, located in the Florida panhandle. The western border (with Santa Rosa Sound) is denoted by a dashedsolid*

~~communities~~areas (Urian *et al.* 1996). Additionally, photo-ID and genetic data from several inshore areas of the southeastern United States also support the existence of resident estuarine animals and a differentiation between animals biopsied along the Atlantic coast and those biopsied within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007; Rosel *et al*. 2009; NMFS unpublished).

Choctawhatchee Bay is located in the Florida panhandle and connected to the Gulf of Mexico by a single pass, East Pass (Figure 1). The bay is approximately 348km^2 in surface area, 43km in length and 2-10km in width (Florida Department of Environmental Protection 2010; Conn et al. 2011). The bay is relatively shallow with steep slopes. Water depth averages 8m in western portions and 3m in eastern portions, with an overall mean depth of 3.8m. Fresh water flows into Choctawhatchee Bay from the Choctawhatchee River primarily (90% of freshwater input), and from numerous small creeks and bayous as well. Salinity varies from 0 to 34ppt on an east to west basis from the river delta in the east to East Pass in the west. Choctawhatchee Bay is bordered by forested wetlands and marshes (FL Department of Environmental Protection 2010). To the north and east, development is limited, partly due to the presence of Eglin Air Force Base. To the south and west are well-developed tourist areas (Conn et al. 2011). Both commercial and recreational fishing, as well as oyster harvesting, occur in Choctawhatchee Bay. Environmental concerns for this area include eutrophication and its associated problems (e.g., harmful algal blooms, hypoxia) and loss of seagrass beds and tidal marshes (FL Department of Environmental Protection 2010).

Bottlenose dolphins utilizing Choctawhatchee Bay are of particular concern to the NMFS due to the potential impacts of recent Unusual Mortality Events (UMEs) on the population (Conn et al. 2011; see ‘Other Mortality’ section). Partly as a result of elevated stranding levels in recent years, Choctawhatchee Bay was chosen by the NMFS as the first in a series of north-central Gulf of Mexico bay, sound and estuary stocks to produce abundance estimates for bottlenose dolphins. Photo-ID surveys were conducted during July-August 2007 and mark-recapture models were used to generate abundance estimates for residents and for residents plus transients (Conn et al. 2011).

The boundaries of this stock include waters of Choctawhatchee Bay from Point Washington and Jolly Bay in the east to Fort Walton Beach in the west as this is the area surveyed during the most recent mark-recapture photo-ID abundance surveys. The boundaries are likely to change as additional research is conducted. Some animals sighted multiple times in Choctawhatchee Bay have also been sighted in Santa Rosa Sound and/or Pensacola Bay to the west (Shippee 2010), suggesting the geographic area encompassing this stock may have to be expanded westward to include some or all of these areas as well. Further research is needed to fully determine the degree of overlap between dolphins inhabiting primarily Choctawhatchee Bay and those inhabiting primarily Pensacola Bay and waters in between, and the degree of genetic exchange between dolphins in these areas. Dolphins have been observed leaving Choctawhatchee Bay through the pass and entering nearshore coastal waters (Shippee 2010). Further information is needed to determine how often this stock utilizes these waters. Information on the use of nearshore waters will be important when considering exposure to coastal fisheries as estuarine animals that make use of nearshore coastal waters would be at risk of entanglement in fishing gear while moving along the coast.

POPULATION SIZE

In order to estimate abundance of residents and of residents plus transients, photo-ID mark-recapture surveys were conducted during July-August 2007 in Choctawhatchee Bay using “racetrack” (sampling the perimeter of the bay, taking about 3 days to complete) and “zigzag” (sampling open waters and sections of the racetrack, taking about 4 days to complete) tracklines (Conn et al. 2011). Each survey was conducted in Beaufort Sea State 3 or less, in good weather, at a survey speed of 12-14kts. Twenty-one percent of dolphins photographed had non-distinctive dorsal fins, and 188 individuals were identified overall. Conn et al. (2011), averaging over all fitted models, estimated resident abundance as 179 (CV=0.04) and resident plus transient abundance as 232 (CV=0.06). Therefore, the best available abundance estimate of the resident Choctawhatchee Bay Stock is 179 (CV=0.04). Because ~~T~~this estimate does not account for the proportion of the population with unmarked fins, it is negatively biased. A reanalysis of the data using a method that accounts for unmarked fins is required for a less negatively biased estimate.

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 for the Choctawhatchee Bay Stock is 179 (CV=0.04). The resulting minimum population estimate is 173.

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. 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 the minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the Choctawhatchee Bay Stock of bottlenose dolphins is 173. 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 this stock of bottlenose dolphins is 1.7.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury of the Choctawhatchee Bay Stock of bottlenose dolphins during ~~2005-2009~~2006-2010 is unknown.

Fishery Information

The commercial fisheries which potentially could interact with this stock are the shrimp trawl, blue crab trap/pot, ~~and~~ stone crab trap/pot, menhaden purse seine, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III). There have been no documented interactions between Choctawhatchee Bay bottlenose dolphins and the shrimp trawl fishery. There have been no documented mortalities of Choctawhatchee Bay bottlenose dolphins in crab trap/pot fisheries. There is no systematic observer coverage of crab trap/pot fisheries; therefore, it is not possible to quantify total mortality. There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery. The menhaden fishery in this area is very limited. During 2010, there was only 1 fishing trip for Walton County, Florida, and none for Okaloosa County, Florida (Florida Fish and Wildlife Conservation Commission 2011).

Hook and Line Fisheries

During 2008 there was 1 mortality resulting from a rescue attempt to disentangle a calf from monofilament line. Also during 2008, an additional live entanglement was documented. The mortality and live entanglement were included in the stranding database and are included in the stranding totals presented in Table 1.

Other Mortality

From ~~2005~~2006 to ~~2009~~2010, ~~63~~47 bottlenose dolphins were reported stranded within the Choctawhatchee Bay Stock area (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~17~~16 November ~~2010~~2011). It was not possible to make any determination of possible human interaction for ~~46~~31 of these strandings. For ~~13~~12 dolphins, no evidence of human interactions was detected. For the remaining 4 dolphins, evidence of human interactions was found, 3 of which were fishery interactions. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals that die or are seriously injured in fishery interactions are discovered, reported or investigated, nor will all of those that are found 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.

Choctawhatchee Bay has been affected by ~~3~~4 recent unusual mortality events (UMEs). First, between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle. This UME started in St. Joseph Bay, Florida, and was concurrent spatially and temporally with a *K. brevis* bloom that spread east to west. There were 62 bottlenose dolphin strandings within Choctawhatchee Bay during this event, which accounted for about 41% of the total bottlenose dolphin strandings associated with this

UME. Second, in March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 105 bottlenose dolphins and 2 unidentified dolphins stranded dead (NOAA 2004). This event also started in St. Joseph Bay, and the majority (76%) of animals stranded in the St. Joseph Bay Stock area with only 2 strandings within Choctawhatchee Bay. Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). Third, a separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins), with 44 (49%) occurring within Choctawhatchee Bay. Finally, an UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 2 animals from this stock were considered to be part of the UME.

Table 1. Bottlenose dolphin strandings occurring in the Choctawhatchee Bay Stock area from 2005 to 2009, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 17 November 2010). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	**Category**	**2005**	**2006**	**2007**	**2008**	**2009**	**Total**
Choctawhatchee Bay Stock	Total Stranded	18[a]	32[b]	8	4	1	63
	Human Interaction						
	---Yes	0	1	0	3	0	4
	---No	2	7	4	0	0	13
	---CBD	16	24	4	1	1	46

[a] This total includes 13 animals that were part of the 2005-2006 UME event.
[b] This total includes 31 animals that were part of the 2005-2006 UME event.

Table 1. Bottlenose dolphin strandings occurring in the Choctawhatchee Bay Stock area from 2006 to 2010, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 16 November 2011). Please note human interaction does not necessarily mean the interaction caused the animal's death.

Stock	**Category**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Choctawhatchee Bay Stock	Total Stranded	32[a]	8	4	1	2	47
	Human Interaction						
	---Yes	1	0	3	0	0	4
	---No	7	4	0	1	0	12
	---CBD	24	4	1	0	2[b]	31

[a] This total includes 31 animals that were part of the 2005-2006 UME event.
[b] The 2 strandings from 2010 are part of the ongoing UME event in the northern Gulf of Mexico.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr et al. 2010; OSAT

2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr et al. 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

STATUS OF STOCK

The status of the Choctawhatchee Bay Stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. The high number of bottlenose dolphin deaths associated with unusual mortality events in the Florida panhandle since 1999 suggests that this stock may be stressed. There are insufficient data to determine population trends for this stock. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Because the stock size and PBR are small, and 2 mortalities or serious injuries would exceed PBR, the NMFS considers this stock to be strategic.

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BOTTLENOSE DOLPHIN (*Tursiops truncatus truncatus*)
St. Joseph Bay Stock

NOTE – NMFS is in the process of writing individual stock assessment reports for each of the 32 bay, sound and estuary stocks of bottlenose dolphins in the Gulf of Mexico. Until this effort is completed and 32 individual reports are available, some of the basic information presented in this report will also be included in the report: "Northern Gulf of Mexico Bay, Sound and Estuary Stocks".

STOCK DEFINITION AND GEOGRAPHIC RANGE

Bottlenose dolphins are distributed throughout the bays, sounds and estuaries of the Gulf of Mexico (Mullin 1988). Long-term (year-round, multi-year) residency by at least some individuals has been reported from nearly every site where photographic identification (photo-ID) or tagging studies have been conducted in the Gulf of Mexico (e.g., Irvine and Wells 1972; Shane 1977; Gruber 1981; Irvine *et al.* 1981; Wells 1986a; Wells *et al.* 1987; Scott *et al.* 1990; Shane 1990; Wells 1991; Bräger 1993; Bräger *et al.* 1994; Fertl 1994; Wells *et al.* 1996a,b; Wells *et al.* 1997; Weller 1998; Maze and Würsig 1999; Lynn and Würsig 2002; Wells 2003; Hubard *et al.* 2004; Irwin and Würsig 2004; Shane 2004; Balmer *et al.* 2008; Urian *et al.* 2009). In many cases, residents predominantly use the bay, sound or estuary waters, with limited movements through passes to the Gulf of Mexico (Shane 1977; Shane 1990; Gruber 1981; Irvine *et al.* 1981; Shane 1990; Maze and Würsig 1999; Lynn and Würsig 2002; Fazioli *et al.* 2006). These eEarly studies indicating year-round residency to bays in both the eastern and western Gulf of Mexico led to the delineation of 33 bay, sound and estuary stocks, including St. Joseph Bay, with the first stock assessment reports in 1995.

More recently, genetic data also support the concept of relatively discrete bay, sound and estuary stocks (Duffield and Wells 2002; Sellas *et al.* 2005). Sellas *et al.* (2005) examined population subdivision among Sarasota Bay, Tampa Bay, Charlotte Harbor, Matagorda Bay, Texas, and the coastal Gulf of Mexico (1-12 km offshore) from just outside Tampa Bay to the south end of Lemon Bay, and found evidence of significant population differentiation among all areas on the basis of both mitochondrial DNA control region sequence data and 9 nuclear microsatellite loci. The Sellas *et al.* (2005) findings support the identification of bay, sound and estuary populationscommunities distinct from those occurring in adjacent Gulf coastal waters. Differences in reproductive seasonality from site to site also suggest genetic-based distinctions among areascommunities (Urian *et al.* 1996). Photo-ID and genetic data from several inshore areas of the southeastern United States also support the existence of resident estuarine animals and a differentiation between animals biopsied

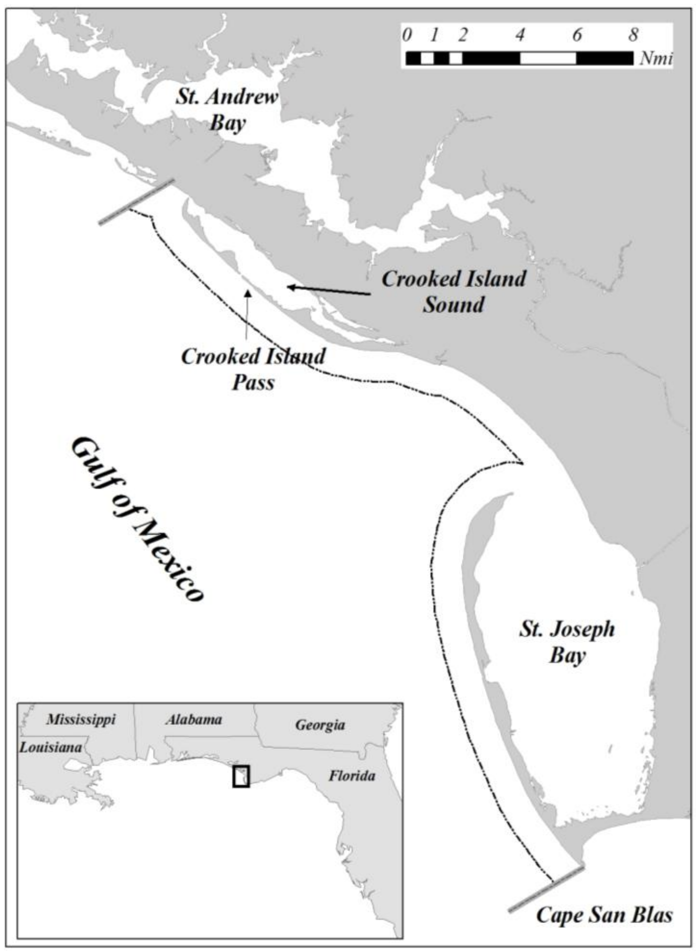

Figure 1. *Geographic extent of the St. Joseph Bay Stock, located in the Florida panhandle. The stock boundaries are denoted by dashed and solid lines.*

along the Atlantic coast and those biopsied within estuarine systems at the same latitude (Caldwell 2001; Gubbins 2002; Zolman 2002; Mazzoil *et al.* 2005; Litz 2007; Rosel *et al*. 2009; NMFS unpublished).

St. Joseph Bay is a relatively small embayment of 170km^2 in area, located just west of Apalachicola in the central panhandle of Florida (Figure 1). The bay is bounded in the south by Cape San Blas, in the west by the St. Joseph Peninsula and opens in the north to the Gulf of Mexico. St. Joseph Bay extends 21km in length and 10km in width at its widest point, and is characterized by extensive seagrass beds and salt marshes. The southern quarter of the bay is 1m or less deep whereas the deepest portions are in the northwest region at ~10m deep. Most of St. Joseph Bay has been designated as an aquatic preserve by the state of Florida. There is minimal freshwater inflow into the bay (U.S. EPA 1999; Balmer 2007; Moretzsohn et al. 2010). To the northwest of St. Joseph Bay, Crooked Island Sound (also known as St. Andrew Sound) extends 12km in length and 2km in width at its widest point. It varies in depth from 1m around the margins of the sound to 6-7m at the sound's entrance (Balmer 2007). The greatest environmental concerns for this area are declining water quality (mainly due to eutrophication), coastal development, loss of seagrass and saltmarsh habitats and beach erosion (Florida Department of Environmental Protection 2008).

In response to 3 unusual mortality events along the Florida panhandle which all impacted the St. Joseph Bay area, Balmer et al. (2008) conducted photo-ID surveys from April 2004 to July 2007 to examine seasonal abundance, distribution patterns and site fidelity of bottlenose dolphins in St. Joseph Bay and along the coast northwest to and inside Crooked Island Sound. In addition, during April 2005 and July 2006, NOAA and the Sarasota Dolphin Research Program along with other partners, conducted health assessments of bottlenose dolphins in the St. Joseph Bay area. Photo-ID data strongly suggested a movement of dolphins into the St. Joseph Bay region during spring and fall with lower abundance during winter and summer. Dolphins sighted in winter and summer displayed higher site fidelity, whereas the majority of dolphins sighted during spring and fall displayed the lowest site fidelity (Balmer et al. 2008). Radio-tracking results supported these findings, with animals tagged in spring 2005 (April) ranging the farthest of all dolphins tagged, extending outside the St. Joseph Bay Stock region. Overall, Balmer et al. (2008) found abundance to vary seasonally in the St. Joseph Bay area, and suggested the St. Joseph Bay area supports a resident community of bottlenose dolphins as well as seasonal visitors during spring and fall seasons.

The St. Joseph Bay Stock area includes St. Joseph Bay, Crooked Island Sound and coastal waters out to 2km from shore in between St. Joseph Bay and Crooked Island Sound, and coastal waters out to 2km from shore from Cape San Blas along St. Joseph Peninsula and along Crooked Island (Figure 1). The boundaries of this stock are based on photo-ID and radio-tracking studies conducted during 2004-2007 (Balmer 2007; Balmer et al. 2008), which support the inclusion of nearshore coastal waters within the boundaries for this particular stock. The boundaries are subject to change as additional research is conducted. There is strong support from the findings of Balmer et al. (2008) to include Crooked Island Sound in the St. Joseph Bay Stock. However, animals from nearby St. Andrew Bay, located to the northwest of St. Joseph Bay (see Figure 1) and surrounding Panama City, have also been sighted in Crooked Island Sound, suggesting Crooked Island Sound is an area of overlap for dolphins inhabiting both St. Joseph Bay and St. Andrew Bay. An example of overlap with St. Andrew Bay is given by Balmer et al. (2010), who show the sightings for a particular animal, tracked simultaneously via satellite-linked transmitter and VHF radio transmitter, sighted in both Crooked Island Sound and St. Andrew Bay as well as adjacent coastal waters.

POPULATION SIZE

In order to estimate seasonal abundance, Balmer et al. (2008) conducted photo-ID mark-recapture surveys across multiple seasons from February 2005 through July 2007 in St. Joseph Bay and along the coast to the northwest including Crooked Island Sound (St. Andrew Sound). Line and contour transects were used to cover the study area, and each survey was only conducted if Beaufort Sea State was 3 or less. Balmer et al. (2008) also calculated a distinctiveness rate, which was the proportion of distinctive (marked) dolphins to non-distinctive (un-marked) dolphins, for each survey season. Mark-recapture estimates factored in the distinctiveness rate and included animals with distinctive and non-distinctive fins. Seasonal abundance estimates using the robust 'Markovian Emigration' model ranged from 122 dolphins (CV=0.09) for summer 2007 to 340 dolphins (CV=0.09) for fall 2006. Summer and winter estimates provide the best estimate of the resident population as spring and fall estimates also include transient animals. Therefore, the best available abundance estimate for the St. Joseph Bay Stock is the average of estimates for winter 2005, summer 2005, winter 2006 and summer 2007, which is 146 dolphins (CV=0.18).

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 for the St. Joseph Bay Stock is 146 (CV=0.18). The resulting minimum population estimate is 126.

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. 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 the minimum population size, one-half the maximum productivity rate, and a ~~"recovery"~~recovery factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the St. Joseph Bay Stock of bottlenose dolphins is 126. 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 this stock of bottlenose dolphins is 1.3.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The total annual human-caused mortality and serious injury to the St. Joseph Bay Stock of bottlenose dolphins during ~~2005-2009~~2006-2010 is unknown.

Fishery Information

The commercial fisheries which potentially could interact with this stock are the shrimp trawl, blue crab trap/pot, stone crab trap/pot, ~~and~~ menhaden purse seine, and Atlantic Ocean commercial passenger fishing vessel (hook and line) fisheries (Appendix III). There have been no documented interactions between St. Joseph Bay bottlenose dolphins and the shrimp trawl fishery, nor any documented interactions with hook and line fisheries. There have been no documented mortalities of St. Joseph Bay bottlenose dolphins in crab trap/pot fisheries. There is no systematic observer coverage of crab trap/pot fisheries; therefore, it is not possible to quantify total mortality. There are no recent observer program data for the Gulf of Mexico menhaden purse seine fishery. The menhaden fishery in this area is very limited, with only ~~3~~2 fishing trips for Gulf County, Florida, during ~~2009~~2010 (Florida Fish and Wildlife Conservation Commission ~~2010~~2011).

Other Mortality

From ~~2005~~2006 to ~~2009~~2010, ~~16~~9 bottlenose dolphins were reported stranded within the St. Joseph Bay Stock area (Table 1; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~17~~16 November ~~2010~~2011). This particular bay, sound and estuary stock includes nearshore coastal waters within its boundaries, and hence strandings that occurred along the coast within the bounds of this stock are also included in the total (Table 1). However, because much of the stock area is contiguous, without physical barriers, with the Northern Coastal Stock of bottlenose dolphins, the stock of origin for animals that strand within the St. Joseph Bay Stock area is uncertain. It was not possible to make a~~ny~~ determination of possible human interactions for any~~15~~ of these strandings. ~~For the 1 remaining stranding, no evidence of human interactions was detected.~~ Stranding data probably underestimate the extent of ~~fishery-related~~human-caused mortality and serious injury because not all of the marine mammals that die or are seriously injured in ~~fishery~~human interactions are discovered, reported or investigated, nor will all of those that are found necessarily show signs of entanglement or other ~~fishery~~human interaction. Finally, the level of technical expertise among stranding network personnel varies widely as does the ability to recognize signs of ~~fishery~~human interactions.

St. Joseph Bay has been affected by 3 recent unusual mortality events (UMEs) and was the geographic focus of an UME in 2004. First, between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *K. brevis* blooms and fish kills in the Florida Panhandle. This UME started in St. Joseph Bay and was concurrent spatially and temporally with a *K. brevis* bloom that spread east to west. There were 43 bottlenose dolphin strandings within the St. Joseph Bay Stock area during this event, which accounted for about 28% of the total bottlenose dolphin strandings for the 1999-2000 UME. Second, in March and April 2004, in another Florida Panhandle UME possibly related to *K. brevis* blooms, 105 bottlenose dolphins and 2 unidentified dolphins stranded dead (NOAA 2004). This event also started in St. Joseph Bay, and 81 (76%) bottlenose dolphins stranded in the St. Joseph Bay Stock area. Although there was no indication of a *K. brevis* bloom at the time, high levels of brevetoxin were found in the stomach contents of the stranded dolphins (Flewelling *et al.* 2005). Third, a separate UME was declared in the Florida Panhandle after elevated numbers of dolphin strandings occurred in association with a *K. brevis* bloom in September 2005. Dolphin strandings remained elevated through the spring of 2006 and brevetoxin was again detected in the tissues of some of the stranded dolphins. Between September 2005 and April 2006 when the event was officially declared over, a total of 90 bottlenose dolphin strandings occurred (plus strandings of 3 unidentified dolphins), with 12 (13%) occurring within the St. Joseph Bay Stock area. Health assessments of dolphins in the stock area found an eosinophilia syndrome, which could over the long-term produce organ damage and alter immunological status and thereby increase vulnerability to other challenges (Schwacke *et al.* 2010). However, the significance of the high prevalence of the syndrome to the observed mortality events in the St. Joseph Bay area is unclear. An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

One research-related mortality occurred during July 2006 in St. Joseph Bay during a NMFS health assessment research project to investigate the above-mentioned UMEs in the region. The animal became entangled deep in the capture net and was found dead during extrication of other animals from the net. The cause of death was determined to be asphyxiation.

Dolphins within the boundaries of this stock, primarily within Crooked Island Sound, have been observed to approach vessels in the area and beg for food (Balmer 2007; Balmer, pers. comm.). Begging behaviors are a result of being illegally fed. It is believed that the animals observed begging within Crooked Island Sound are members of the St. Andrew Bay Stock (the St. Andrew Bay Stock encompasses Panama City, an area where illegal feeding has been documented [Samuels and Bejder 2004]). Three dolphins, which were captured in Crooked Island Sound during the April 2005 health assessment, were observed begging during the 3 months of subsequent radio tracking (Balmer 2007; Balmer, pers. comm.). Two of these individuals, a mom/calf pair, were sighted exclusively within the boundaries of the St. Andrew Bay Stock during all radio tracking surveys. Both of these individuals were found stranded within 2 days of each other on 1 November and 3 November 2005 near Panama City and Panama City Beach. The other individual, an adult male, which was documented in Balmer *et al.* (2010), was sighted frequently in the waters from St. Andrew Bay to Crooked Island Sound and in association with individuals from both the St. Andrew Bay and St. Joseph Bay Stocks. Thus, the begging behaviors and overlap by individuals of the St. Andrew Bay Stock are likely affecting the behavior of individuals in the St. Joseph Bay Stock.

~~Table 1. Bottlenose dolphin strandings occurring in the St. Joseph Bay Stock area from 2005 to 2009, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 17 November 2010). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that some animals included in this table may belong to the Gulf of Mexico Northern Coastal Stock since the boundaries for this stock include coastal waters.~~

~~Stock~~	~~Category~~	~~2005~~	~~2006~~	~~2007~~	~~2008~~	~~2009~~	~~Total~~
~~St. Joseph Bay Stock~~	~~Total Stranded~~	~~7[a]~~	~~7[b]~~	~~1~~	~~1~~	~~0~~	~~16~~
	~~Human Interaction~~						
	~~---Yes~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
	~~---No~~	~~1~~	~~0~~	~~0~~	~~0~~	~~0~~	~~1~~
	~~---CBD~~	~~6~~	~~7~~	~~1~~	~~1~~	~~0~~	~~15~~

~~[a] This total includes 7 animals that were part of the 2005-2006 UME event.~~

[b] This total includes 5 animals that were part of the 2005-2006 UME event.

Table 1. Bottlenose dolphin strandings occurring in the St. Joseph Bay Stock area from 2006 to 2010, as well as number of strandings for which evidence of human interaction was detected and number of strandings for which it could not be determined (CBD) if there was evidence of human interaction. Data are from the NOAA National Marine Mammal Health and Stranding Response Database (unpublished data, accessed 16 November 2011). Please note human interaction does not necessarily mean the interaction caused the animal's death. Please also note that some animals included in this table may belong to the Gulf of Mexico Northern Coastal Stock since the boundaries for this stock include coastal waters.

Stock	**Category**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
St. Joseph Bay Stock	Total Stranded	7[a]	1	1	0	0	9
	Human Interaction						
	---Yes	0	0	0	0	0	0
	---No	0	0	0	0	0	0
	---CBD	7	1	1	0	0	9

[a] This total includes 5 animals that were part of the 2005-2006 UME event.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr et al. 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr et al. 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

A substantial number of beaches and wetlands along the Louisiana coast experienced heavy or moderate oiling (OSAT-2 2011). The heaviest oiling in Louisiana occurred west of the Mississippi River on the Mississippi Delta and in Barataria and Terrebonne Bays, and to the east of the river on the Chandeleur Islands. Some heavy to moderate oiling occurred on Alabama and Florida beaches, with the heaviest stretch occurring from Dauphin Island, Alabama, to Gulf Breeze, Florida. Light to trace oil was reported along the majority of Mississippi barrier islands, from Gulf Breeze to Panama City, Florida, and outside of Atchafalaya and Vermilion Bays in western Louisiana (OSAT-2 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing. For coastal and estuarine dolphins, the NOAA-led efforts include: active surveillance to detect stranded animals in remote locations; aerial surveys to document the distribution, abundance, species and exposure of marine mammals and sea turtles relative to oil from DWH spill; assessment of sublethal and chronic health impacts on coastal and estuarine bottlenose dolphins in Barataria Bay, Louisiana, and a reference site in Sarasota Bay, Florida; and assessment of injuries to dolphin stocks in Barataria Bay and Chandeleur Sound, Louisiana, Mississippi Sound, and as a reference site, St. Joseph Bay, Florida.

Coastal dolphins have been observed with tar balls attached to them and seen swimming through oil slicks close to shore and inland bays (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

STATUS OF STOCK

The status of the St. Joseph Bay Stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. The high number of bottlenose dolphin deaths which occurred during the mortality events in the Florida panhandle since 1999 suggests that this stock may be stressed. There are insufficient data to determine population trends for this stock. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Because the stock size and PBR are small, and 2 mortalities or serious injuries would exceed PBR, the NMFS considers this stock to be strategic.

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

STOCK DEFINITION AND GEOGRAPHIC RANGE

There are 2 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 2 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 (Figure 1; Fulling *et al.* 2003; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). Atlantic spotted dolphins were seen in all seasons during GulfCet aerial surveys of the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) from 1992 to 1998 (Hansen *et al.* 1996; Mullin and Hoggard 2000). 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).

The Gulf of Mexico population is being considered a separate stock for management purposes. In a recent study, Adams and Rosel (2005) 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

The current population size for the Atlantic spotted dolphin in the northern Gulf of Mexico is unknown because the survey data from the continental shelf that covers the majority of this stock's range are more than 8 years old (Wade and Angliss 1997).

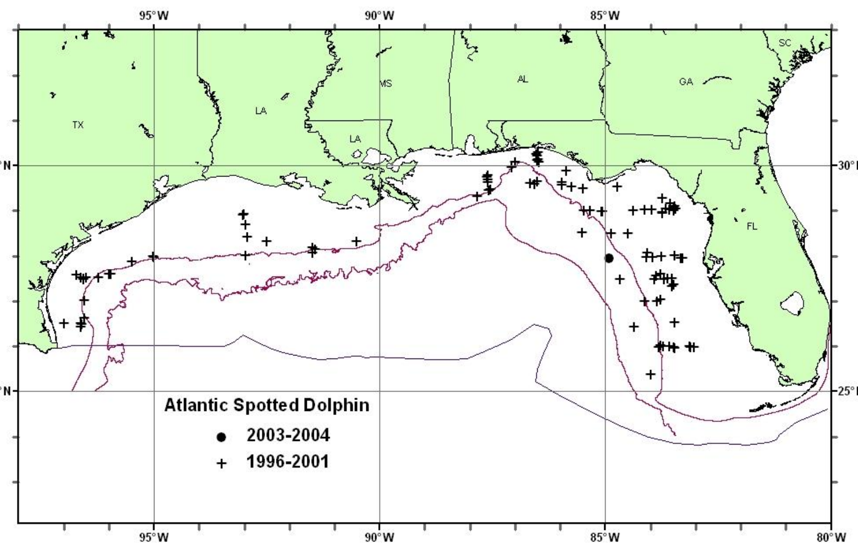

Figure 1. *Distribution of Atlantic spotted dolphin sightings from SEFSC spring and fall vessel surveys during 1996-2001 and from summer 2003 and spring 2004- surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier aAbundance eEstimates

All Eestimates 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 sightingline-transect survey data collected from ships in the northern Gulf of Mexico, and are summarized in Appendix IV.

- From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annualline-transect vessel surveys were conducted in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico in oceanic waters (i.e., from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ)) (Hansen *et al.* 1995). Annual

~~cetacean surveys were conducted~~ along a fixed plankton sampling trackline. Due to limited survey effort in any given year, the ~~S~~survey effort-weighted estimated average abundance of Atlantic spotted dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 3,213 (CV=0.44) (Hansen *et al.* 1995), and for 1996 to 2001, 175 (CV=0.84) (Mullin and Fulling 2004). ~~This is an~~These were underestimates because the continental shelf was not ~~entirely~~ covered during these surveys.

Data were also collected from ~~1996~~1998 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 the 20m to the 200m isobaths ~~in the fall of 1998 through 2001~~. ~~As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates using data older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations.~~ The estimated abundance of Atlantic spotted dolphins, pooled from 2000 through 2001, for the fall outer continental shelf ~~shipboard~~ surveys was 37,611 (CV=0.28) (~~Figure 1;~~ Table 1; see Fulling *et al.* 2003). ~~Spring surveys were 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 (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 areas. The estimate of abundance for Atlantic spotted dolphins in oceanic waters, pooled from 1996 through 2001, was 175 (CV=0.84) (Mullin and Fulling 2004).~~

~~**Recent surveys and abundance estimates**~~

During summer 2003 and spring 2004, ~~line-transect~~ surveys dedicated to estimating ~~the~~cetacean abundance ~~of oceanic cetaceans~~ were conducted in oceanic waters ~~in the northern Gulf of Mexico. During each year~~along~~,~~ a grid of uniformly-spaced transect lines from a random start ~~were surveyed from the 200m isobath to the seaward extend of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007)~~. The abundance estimate ~~of abundance~~ for Atlantic spotted dolphins in oceanic waters, pooled from 2003 to 2004, was 0 (Mullin 2007). ~~Because most of the data for oceanic estimates prior to 2003 were older than the 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable for oceanic waters.~~

The ~~previous~~most recent best abundance estimate for the Atlantic spotted dolphin in the northern Gulf of Mexico was the combined estimate of abundance for both the outer continental shelf (fall surveys, 2000-2001) and oceanic waters (spring and summer surveys, 2003-2004), which was 37,611 (CV=0.28) (Table 1). Because these data ~~from the continental shelf portion of this estimate~~ are more than 8 years old, the current best population estimate is unknown.

Table 1. Most recent abundance estimates (N_{best}) and coefficient of variation (CV) of Atlantic spotted dolphins in the northern Gulf of Mexico outer continental shelf (OCS) (waters 20-200m deep) during fall 2000-2001 and oceanic waters (200m to the offshore extent of the EEZ) during spring/summer 2003-2004.

Month/Year	**Area**	**N_{best}**	**CV**
Fall 2000-2001	Outer Continental Shelf	37,611	0.28
Spring/Summer 2003-2004	Oceanic	0	-
Fall & Spring/Summer	**OCS & Oceanic**	**37,611**	**0.28**

Minimum Population Estimate

The current minimum population estimate is unknown. 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).

Current Population Trend

There are insufficient data to determine the population trend 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 ~~b~~Biological ~~r~~Removal ~~level~~ (PBR) is currently undetermined. PBR is the product of the minimum population size, one half the maximum net productivity rate and a ~~"recovery"~~recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

Annual human-caused mortality and serious injury is unknown for this stock. There has been no reported fishing-related mortality or serious injury of an Atlantic spotted dolphin during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). One mortality occurred during 2006 off Ft. Myers, Florida, when a dolphin was captured during sea turtle relocation trawling activities. As part of its annual coastal dredging program, the Army Corps of Engineers conducts sea turtle relocation trawling during hopper dredging as a protective measure for marine turtles. This mortality was included in the stranding database and is included in Table 2.

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.~~ The commercial fisheries which potentially could interact with this stock in the Gulf of Mexico are the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery and the Southeastern U.S. Atlantic/Gulf of Mexico shrimp trawl fishery (Appendix III).

Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There has been no reported mortality or serious injury of an Atlantic spotted dolphin in the pelagic longline fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).~~There were 2 observed incidental takes and releases of spotted dolphins in the northern Gulf of Mexico during 1994, but no recent reported takes of Atlantic spotted dolphins by this fishery. 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).~~

A voluntary observer program for the shrimp trawl fishery began in 1992 and became mandatory in 2007. During 1992-200~~7~~8 the shrimp trawl fishery observer program recorded 6 unidentified dolphins caught in a lazy line or turtle excluder device, and 1 or more of these animals may have been an Atlantic spotted dolphin. In 2 of the 6 cases, an observer report indicated the animal may have already been decomposed, but this could not be confirmed in the absence of a necropsy. In 2008, an additional dolphin carcass was caught on the tickler chain of a shrimp trawl; however, the animal's carcass was severely decomposed and may have been captured in this state. It is likely the unidentified carcass belonged to the bottlenose dolphin Western Coastal Stock or Continental Shelf Stock, or possibly to the Atlantic spotted dolphin stock.

Other Mortality

A total of ~~25~~16 Atlantic spotted dolphins were reported stranded in the Gulf of Mexico during ~~1999-2007~~2006-2010 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~-September 2008; Table 2 displays 2003-2007 data~~). Evidence of human interactions was detected for 2 stranded animals, no evidence of human interactions was detected for 2 animals, and for the remaining 12 animals, it could not be determined if there was evidence of human interactions~~ that stranded in Alabama during 2004, both of 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.

~~In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 UMEs have been declared in the Gulf of Mexico,~~ Since 1990, there have been 12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and ~~2~~3 of these included Atlantic spotted dolphins. 1) Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *Karenia brevis* blooms and fish kills in the Florida Panhandle. Additional strandings included 3 Atlantic spotted dolphins, 1 Risso's dolphin, *Grampus griseus*, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins. 2) In 2005, a particularly destructive red tide (*K. brevis*) bloom occurred off of central west Florida. Manatee, sea turtle, bird and fish mortalities were reported in the area in early 2005 and a manatee UME had been declared. Bottlenose dolphin mortalities began to rise above the historical averages by late July 2005, continued to increase through October 2005, and were then declared to be part of a multi-species UME. The multi-species UME extended into 2006, and ended in November 2006. A total of 190 dolphins were involved, primarily bottlenose dolphins plus strandings of 1 Atlantic spotted dolphin and 24 unidentified dolphins. The evidence suggests the effects of a red tide bloom contributed to the cause of this event. 3) An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 3 animals from this stock were considered to be part of the UME.

~~Table 2. Atlantic spotted dolphin (*Stenella frontalis*) strandings along the northern Gulf of Mexico coast, 2003-2007.~~

~~STATE~~	~~2003~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	~~TOTAL~~
~~Alabama~~	~~1~~	~~4~~	~~0~~	~~0~~	~~1~~	~~6~~
~~Florida~~	~~1~~	~~4~~	~~2~~	~~0~~	~~7~~	~~14~~
~~Louisiana~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Mississippi~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Texas~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~TOTAL~~	~~2~~	~~8~~	~~2~~	~~0~~	~~8~~	~~20~~

Table 2. Atlantic spotted dolphin (*Stenella frontalis*) strandings along the northern Gulf of Mexico coast, 2006-2010.

STATE	**2006**	**2007**	**2008**	**2009**	**2010**	**TOTAL**
Alabama	0	1	0	0	0	1
Florida	1	7	0	4	3*	15
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	0	0	0	0	0
TOTAL	1	8	0	4	3	16

*These strandings are included in the Northern Gulf of Mexico UME

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr et al. 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr et al. 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Despite an undetermined PBR and unknown population size, this is not a strategic stock because previous estimates of population size have been large compared to the number of cases of documented human-related mortality and serious injury.

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PANTROPICAL SPOTTED DOLPHIN (*Stenella attenuata 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 (i.e., U.S. Gulf of Mexico) (Figure 1; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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). Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), pantropical spotted dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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.

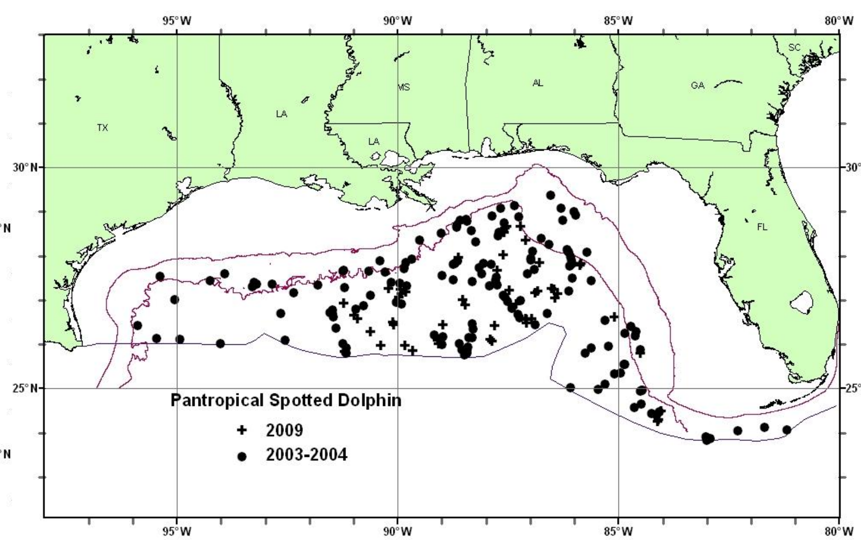

Figure 1. *Distribution of pantropical spotted dolphin sightings from SEFSC spring vessel surveys during 1996-2001 and from summer 2003 and spring 2004, and during summer 2009 surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

POPULATION SIZE

The best abundance estimate available for northern Gulf of Mexico pantropical spotted dolphins is 50,88034,067 (CV=0.270.18); (Mullin 2007; Table 1). This estimate is pooled from a summer 20092003 and spring 2004 oceanic surveys covering waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ).

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of pantropical spotted dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 31,320 (CV=0.20) (Hansen *et al.* 1995), and for 1996 to 2001, 91,321 (CV=0.16) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for pantropical spotted dolphins, pooled from 2003 to 2004, was 34,067 (CV=0.18) (Mullin 2007; Table 1).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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of pantropical spotted dolphins for all surveys combined was 31,320 (CV=0.20) (Hansen *et al.* 1995; Table 1).

Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 91,321 (CV=0.16) (Mullin and Fulling 2004; Table 1).

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for pantropical spotted dolphins in oceanic waters during 2009 was 50,880 (CV=0.27; Table 1).During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for pantropical spotted dolphins in oceanic waters, pooled from 2003 to 2004, was 34,067 (CV=0.18) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Table 1. Summary of abundance estimates for northern Gulf of Mexico 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
Apr-Jun 1991-1994	Oceanic waters	31,320	0.20
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	91,321	0.16
Jun-Aug 2003, Apr-Jun 2004 (pooled)	Oceanic waters	34,067	0.18
Jun-Aug 2009	Oceanic waters	50,880	0.27

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 50,88034,067 (CV=0.270.18). The minimum population estimate for the northern Gulf of Mexico is 40,69929,311 pantropical spotted dolphins.

Current Population Trend

~~There are insufficient data to determine the population trends for this stock. The pooled abundance estimate for 2003-2004 of 34,067 (CV=0.18) and that for 1996-2001 of 91,321 (CV=0.16) are significantly different (P<0.05). However, the 2003-2004 estimate is similar to that for 1991-1994 of 31,320 (CV=0.20). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of pantropical spotted dolphin abundance.~~ Four point estimates of pantropical spotted dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of pantropical spotted dolphin abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 40,699~~29,311~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 stock is 407~~293~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury for this stock during ~~2005~~2006-~~2009~~2010 is 3.2 pantropical spotted dolphins (CV=0.69; Table 2).

Fisheries Information

The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). ~~The level of past or current, direct, human-caused mortality of pantropical spotted dolphins in the northern Gulf of Mexico is unknown; however, interactions between pantropical spotted dolphins and the pelagic longline fishery have been observed in the Gulf of Mexico.~~ Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to pantropical spotted dolphins by this fishery during 1998-2008 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009). However, during 2009, 4 pantropical spotted dolphins were observed to be seriously injured (3 during quarter 2 and 1 during quarter 4) and 1 pantropical spotted dolphin was released alive with no presumed serious injury after entanglement interactions with the pelagic longline fishery (Garrison and Stokes 2010). Estimated serious injuries of pantropical spotted dolphins attributable to the pelagic longline fishery in the Gulf of Mexico region totaled 15.9 (CV=0.69) in 2009. During 2010, 2 pantropical spotted dolphins were released alive with no presumed serious injuries after entanglement interactions with the pelagic longline fishery (Garrison and Stokes 2011). One of the entanglements occurred during experimental fishing to test the effectiveness of "weak" hooks as a potential bycatch mitigation tool. There was 100% observer coverage of all experimental sets. The average annual serious injury and mortality in the Gulf of Mexico pelagic longline fishery for the 5-year period from ~~2005~~2006 to ~~2009~~2010 is 3.2

(CV=0.69; Table 2).

~~Table 2. Summary of the incidental mortality and serious injury of Gulf of Mexico pantropical spotted dolphins in the Pelagic Longline fishery including the years sampled (Years), 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~~	~~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~~	~~05-09~~	~~Obs. Data Logbook~~	~~.07, .08, .15, .25, .21~~	~~0, 0, 0, 0, 4~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 0, 16~~	~~0, 0, 0, 0, 0~~	~~0, 0, 0, 0, 16~~	~~NA, NA, NA, NA, .69~~	~~3.2 (.69)~~

~~[a] Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC).~~

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico pantropical spotted dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels [a]	Data Type [b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	06-10	47, 55, 53, 47, 46	Obs. Data Logbook	.08, .14, .25, .21, .26	0,0,0,4,0	0,0,0,0,0	0,0,0,16.0, 0	0,0,0,0,0	0,0,0,16.0, 0	NA, NA ,NA, .69, NA	3.2 (0.69)
TOTAL											3.2 (0.69)

a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.

Other Mortality

Five pantropical spotted dolphins were reported stranded in the Gulf of Mexico during ~~2005-2009~~2006-2010 (~~2 in Florida in 2008 and 2009, 2 in Alabama in 2005 and 2009, and 1 in Texas in 2009;~~ NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed ~~17~~16 November 20~~10~~11). There was 1 stranding of a pantropical spotted dolphin during 2008 (in Florida), 3 strandings during 2009 (in Florida, Texas and Alabama) and 1 stranding during 2010 (in Texas). No evidence of human interactions was detected for 2 of these stranded animals, and for the remaining 3 animals, it could not be determined if there was 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1

~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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 stock. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-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 (i.e., U.S. Gulf of Mexico) occur in oceanic waters (Figure 1; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), striped dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico striped dolphins is 1,8493,325 (CV=0.770.48); (Mullin 2007; Table 1). This estimate is pooled from a summer 2009 2003 and spring 2004 oceanic surveys covering waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ).

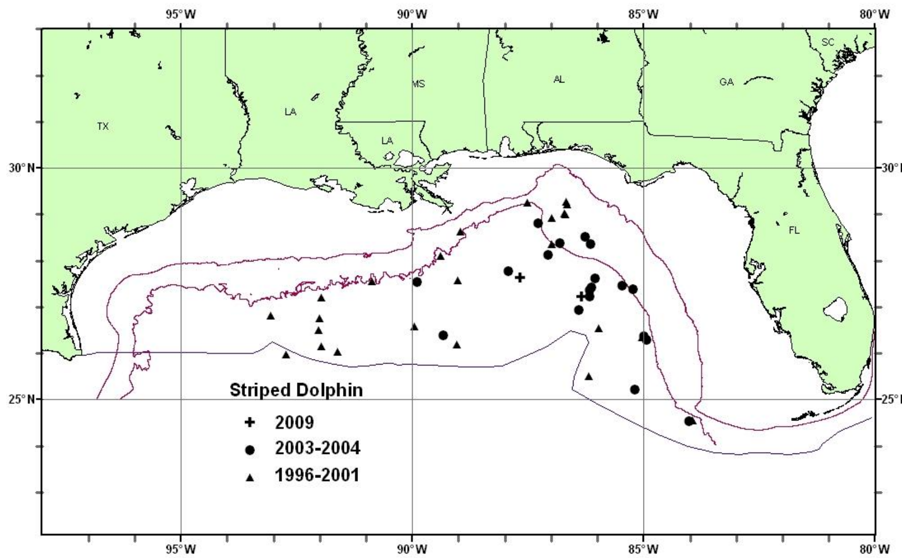

Figure 1. *Distribution of striped dolphin sightings from SEFSC spring vessel surveys during spring 1996-2001, and from summer 2003 and spring 2004, and summer 2009 surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of striped dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 4,858 (CV=0.44) (Hansen *et al.* 1995), and for 1996 to 2001, 6,505 (CV=0.43) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for striped dolphins, pooled from 2003 to 2004, was 3,325 (CV=0.48) (Mullin 2007; Table 1).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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of striped dolphins for all surveys combined was 4,858 (CV=0.44) (Hansen *et al.* 1995; Table 1). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 6,505 (CV=0.43) (Mullin and Fulling 2004; Table 1).

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for striped dolphins in oceanic waters during 2009 was 1,849 (CV=0.77; Table 1).During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for striped dolphins in oceanic waters, pooled from 2003 to 2004, was 3,325 (CV=0.48) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico.

Table 1. Summary of abundance estimates for northern Gulf of Mexico 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
Apr-Jun 1991-1994	Oceanic waters	4,858	0.44
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	6,505	0.43
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	3,325	0.48
Jun-Aug 2009	Oceanic waters	1,849	0.77

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 1,8493,325 (CV=0.770.48). The minimum population estimate for the northern Gulf of Mexico is 1,0412,266 striped dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 3,325 (CV=0.48) and that for 1996-2001 of 6,505 (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. These estimates are similar to that for 1991-1994 of 4,858 (CV=0.44). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of striped dolphin abundance. Four point estimates of striped dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of more than three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of striped dolphin abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 1,041~~2,266~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 10~~23~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality or serious injury of striped dolphins during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Fisheries Information

~~The level of past or current, direct, human-caused mortality of striped dolphins in the northern Gulf of Mexico is unknown.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to striped dolphins by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Other Mortality

Three striped dolphins were reported stranded in the Gulf of Mexico during 2006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011). One striped dolphin stranded during 2006 in Florida, 1 stranded during 2007 in Louisiana, and 1 stranded during 2008 in Mississippi. Evidence of human interactions was detected for 1 of the stranded animals, and for the remaining 2, it could not be determined if there was evidence of human interactions. ~~During 2007, 1 striped dolphin stranded in Louisiana, and during 2006, 1 striped dolphin stranded alive in Florida with evidence of human interaction from a boat collision. There were 2 reported strandings of a striped dolphin in the Gulf of Mexico during 1999-2005. No evidence of human interactions was detected for these stranded animals (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 September 2008).~~ 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1

February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For oceanic dolphins the NOAA-led effortsFor continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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SPINNER DOLPHIN (*Stenella longirostris 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 (i.e., U.S. Gulf of Mexico) occur in oceanic waters and generally east of the Mississippi River (Figure 1; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), spinner dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico spinner dolphins is 11,441~~1,989~~ (CV=0.83~~0.48)~~; ~~(Mullin 2007;~~ Table 1). This estimate is ~~pooled~~ from a summer 2009 ~~2003 and spring 2004~~ oceanic survey~~s~~ covering waters from the 200m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~.

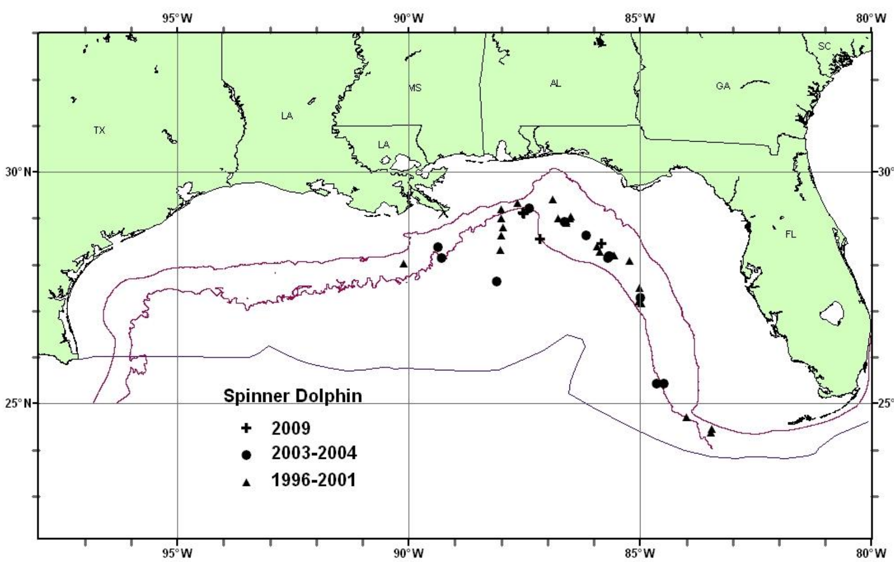

Figure 1. *Distribution of spinner dolphin sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004, and summer 2009 ~~surveys~~. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of spinner dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 6,316 (CV=0.43) (Hansen *et al.* 1995), and for 1996 to 2001, 11,971 (CV=0.71) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for spinner dolphins, pooled from 2003 to 2004, was 1,989 (CV=0.48) (Mullin 2007; Table 1).~~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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of spinner dolphins for all surveys combined was 6,316 (CV=0.43) (Hansen *et al.* 1995; Table 1). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 11,971 (CV=0.71) (Mullin and Fulling 2004; Table 1).~~

Recent survey~~s~~ and abundance estimate~~s~~

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico~~ using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for spinner dolphins in oceanic waters during 2009 was 11,441 (CV=0.83; Table 1).~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for spinner dolphins in oceanic waters, pooled from 2003 to 2004, was 1,989 (CV=0.48) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico.~~

Table 1. Summary of abundance estimates for northern Gulf of Mexico spinner 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
Apr-Jun 1991-1994	Oceanic waters	6,316	0.43
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	11,971	0.71
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	1,989	0.48
Jun-Aug 2009	Oceanic waters	11,441	0.83

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 11,441~~1,989~~ (CV=0.83~~0.48~~). The minimum population estimate for the northern Gulf of Mexico is 6,221~~1,356~~ spinner dolphins.

Current Population Trend

~~There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 1,989 (CV=0.48) and that for 1996-2001 of 11,971 (CV=0.71) are significantly different (P<0.05). The 1991-1994 estimate of 6,316 (CV=0.43) was intermediate to these two estimates. These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of spinner dolphin abundance.~~ Four point estimates of spinner dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of six. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of spinner dolphin abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 6,221~~1,356~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 62~~14~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of spinner dolphins during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Fisheries Information

~~The level of past or current, direct, human-caused mortality of spinner dolphins in the northern Gulf of Mexico is unknown.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to spinner dolphins by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

~~.~~

Other Mortality

Eleven spinner dolphins~~There~~ were ~~6~~ reported strand~~ings~~ed ~~of spinner dolphins~~ in the Gulf of Mexico during ~~1999-2007~~2006-2010 (~~2 in Alabama during 2003, 1 in Florida during 2002, and 3 in Texas during 2003 and 2004~~Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008~~). Evidence of human interactions was detected for 1 stranded spinner dolphin, which stranded alive visibly oiled during June 2010 near Pensacola, Florida. No evidence of human interaction was detected for 1 stranded spinner dolphin, and for the remaining 9 spinner dolphins, it could not be determined if there was evidence of human interactions. ~~Evidence of human interaction was detected for 1 animal that stranded during 2003 in Texas. This animal had monofilament line around its tail stock but not into the skin, and abrasions around its flukes as though the animal had been towed. In addition, possible propeller marks were noted.~~ 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 7 animals from this stock were considered to be part of the UME.

Table 2. Spinner dolphin (*Stenella longirostris longirostris*) strandings along the northern Gulf of Mexico coast, 2006-2010.

STATE	**2006**	**2007**	**2008**	**2009**	**2010**	**TOTAL**
Alabama	0	0	0	3	0	3
Florida	0	0	0	0	7*	7
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	0	0	0	1	1
TOTAL	0	0	0	3	8	11

*These strandings are included in the Northern Gulf of Mexico UME

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For oceanic dolphins the NOAA-led effortsFor continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. For large whales, oil can foul the baleen they use to filter-feed. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-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 to a lesser extent continental shelf waters in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) (Figure 1; Fulling *et al.* 2003; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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). Four dolphins from a mass stranding of 62 animals in the Florida Panhandle in December 1997 were rehabilitated and released in 1998, and satellite-linked transmitters tracked for 4 to 112 days. A report after 5 months indicated that the animals returned to, and remained in, Gulf waters averaging about 195m deep offshore of the original stranding site (Wells *et al.* 1999).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), rough-toothed dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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), nor information on whether more than 1 stock may exist in the Gulf of Mexico. Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The current population size for the rough-toothed dolphin in the northern Gulf of Mexico is ~~unknown because the survey data from the continental shelf that covers a significant portion of this stock's range are more than 8 years old (Wade and Angliss 1997)~~624 (CV=0.99; Table 1). This estimate is from a summer 2009 oceanic survey covering waters from the 200m isobath to the seaward extent of the U.S. EEZ.

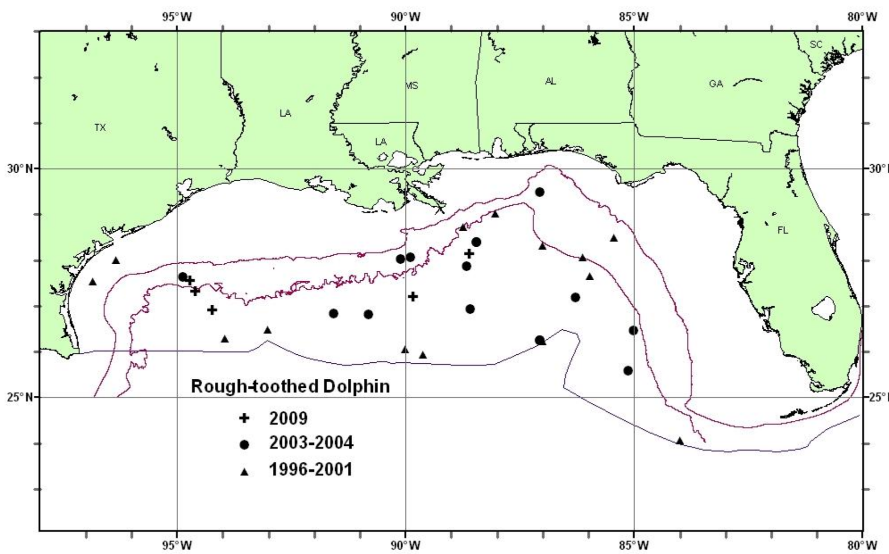

Figure 1. *Distribution of rough-toothed dolphin sightings from SEFSC ~~spring and fall~~ vessel surveys during spring and fall 1996-2001, ~~and from~~ summer 2003 and spring 2004, and summer 2009 ~~surveys~~. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the northern Gulf of Mexico, and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring in oceanic waters (i.e., 200m isobath to seaward extent of the U.S. EEZ) along a fixed plankton sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of rough-toothed dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 852 (CV=0.31) (Hansen *et al.* 1995), and for 1996 to 2001, 985 (CV=0.44) (Mullin and Fulling 2004). These may be underestimates because the continental shelf was not covered during these surveys, although the extent to which rough-toothed dolphins use continental shelf waters and any seasonal component to use are not well known.

Data were also collected from 1998 to 2001 during fall plankton surveys. Tracklines, which were perpendicular to the bathymetry, covered shelf waters from the 20m to the 200m isobaths. The estimated abundance of rough-toothed dolphins, pooled from 2000 through 2001, for the fall outer continental shelf surveys was 1,145 (CV=0.83) (Table 1; see Fulling *et al.* 2003).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted in oceanic waters along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for rough-toothed dolphins in oceanic waters, pooled from 2003 to 2004, was 1,508 (CV=0.39) (Mullin 2007).

The previous best abundance estimate for the rough-toothed dolphin in the northern Gulf of Mexico was the combined estimate of abundance for both the outer continental shelf (fall surveys, 2000-2001) and oceanic waters (spring and summer surveys, 2003-2004), which was 2,653 (CV=0.42).

~~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 in conjunction with bluefin tuna ichthyoplankton surveys 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). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. 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 area was not entirely covered.~~

~~Similar surveys were conducted during spring 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 (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. The estimate of abundance for rough-toothed dolphins in oceanic waters, pooled from 1996 through 2001, was 985 (CV=0.44) (Mullin and Fulling 2004). Data were collected from 1998 to 2001 during fall plankton surveys. Tracklines, which were perpendicular to the bathymetry, covered shelf waters from 20 to 200m deep in the fall of 1998 through 2001 (Figure 1; Table 1; see Fulling *et al.* 2003). As recommended in the GAMMS Workshop Report (Wade and Angliss 1997), estimates using data older than 8 years are deemed unreliable, and therefore should not be used for PBR determinations. The estimated abundance of rough-toothed dolphins was based on data pooled from 2000 through 2001, for the outer continental shelf shipboard surveys and was 1,145 (CV=0.83) (see Fulling *et al.* 2003).~~

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico ~~using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for rough-toothed dolphins in oceanic waters during 2009 was 624 (CV=0.99; Table 1). This is the most reliable current estimate for the northern Gulf of Mexico. Rough-toothed dolphins are uncommon in Gulf of Mexico continental shelf waters and their use of these waters may be seasonal. A previous abundance estimate for continental shelf waters was based on sightings of two groups off Texas off during fall surveys conducted during 2000-2001 (Fulling *et al.* 2003; Figure 1; Table 1). During a similar survey of continental shelf waters west of Cape San Blas, Florida (about -85 degrees W) during summer 2007, no rough-toothed dolphin groups were sighted (NMFS 2007). ~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter*. The estimate of abundance for rough-toothed dolphins in oceanic waters from 2003 and 2004 was 1,508 (CV=0.39) (Mullin 2007).~~

~~Because most of the data for oceanic estimates prior to 2003 were older than the 8-year limit and due to the different oceanic sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable for~~

oceanic waters. The previous abundance estimate for the rough-toothed dolphin in the northern Gulf of Mexico was the combined estimate of abundance for both the outer continental shelf (fall surveys, 2000-2001) and oceanic waters (spring and summer surveys, 2003-2004), which was 2,653 (CV=0.42). Because data from the continental shelf portion of this estimate are more than 8 years old, the current best population estimate is unknown.

Table 1. Most recent abundance estimates (N_{best}) and coefficient of variation (CV) of rough-toothed dolphins in the northern Gulf of Mexico outer continental shelf (OCS) (waters (20-200m deep) during fall 2000-2001 and oceanic waters (200m to the offshore extent of the EEZ) during spring/summer 2003-2004 and summer 2009.

Month/Year	Area	N_{best}	CV
Fall 2000-2001	Outer Continental Shelf	1,145	0.83
Spring/Summer 2003 -2004	Oceanic	1,508	0.39
Spring/Summer & Fall	OCS & Oceanic	2,653	0.42
Summer 2009	Oceanic	624	0.99

Minimum Population Estimate

The current minimum population estimate is unknown. 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 624 (CV=0.99). The minimum population estimate for northern Gulf of Mexico rough-toothed dolphins is 311.

Current Population Trend

There are insufficient data to determine the population trends for this species. Two point estimates of rough-toothed dolphin abundance have been made based on data from oceanic surveys during 2003-2004 and 2009. The estimates vary by a factor of more than two. To determine whether changes in oceanic abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of rough-toothed dolphin abundance. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance. Additionally, the extent to which rough-toothed dolphins inhabit continental shelf waters and whether there is movement between these waters and oceanic waters needs to be resolved.

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 undetermined. Potential Biological Removal (PBR) is the product of the minimum population size, one half the maximum net productivity rate and a "recovery" recovery factor (MMPA Sec. 3.16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size is unknown311. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" 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 3.1.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality or serious injury of rough-toothed dolphins during 1992-20072010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Fisheries Information

The level of past or current, direct, human-caused mortality of rough-toothed dolphins in the northern Gulf of Mexico is unknown. The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to rough-toothed dolphins by this fishery in the northern Gulf of Mexico during 1992-20071998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Other Mortality

There were 650 stranded rough-toothed dolphins in the northern Gulf of Mexico during 2006-20101999-2007, including a mass stranding of 19 animals in February 2001, a mass stranding of 12 animals in September 2004, and a mass stranding of 11 animals in March 2005 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 September 2008; Table 2 displays 2003-2007 data November 2011). No evidence of human interactions was detected 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

Table 2. Rough-toothed dolphin (*Steno bredanensis*) strandings along the northern Gulf of Mexico coast, 2003-2007.

STATE	2003	2004	2005	2006	2007	TOTAL
Alabama	0	0	0	0	0	0
Florida	1	12[a]	11[b]	1	1	26
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	1	1	1	0	3
TOTAL	1	13	12	2	1	29

[a] Florida mass stranding of 12 animals in September 2004
[b] Florida mass stranding of 11 animals in March 2005

Table 2. Rough-toothed dolphin (*Steno bredanensis*) strandings along the northern Gulf of Mexico coast, 2006-2010.

STATE	2006	2007	2008	2009	2010	TOTAL

Alabama	0	0	0	0	0	0
Florida	1	1	1	1	1	5
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	1	0	0	0	0	1
TOTAL	2	1	1	1	1	6

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Despite an undetermined PBR, this is not a strategic stock because there is no documented human-related mortality and serious injury.

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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 (i.e., U.S. Gulf of Mexico) occur primarily over the deeper waters off the continental shelf and primarily west of the Mississippi River (Mullin *et al.* 1994; Maze-Foley and Mullin 2006; Figure 1). 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).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997), Clymene dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico Clymene dolphins is 129~~6,575~~ (CV=1.00~~0.36) (Mullin 2007~~; Table 1). This estimate is ~~pooled~~ from a summer 2009~~2003 and spring 2004~~ oceanic survey~~s~~ covering waters from the 200m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~.

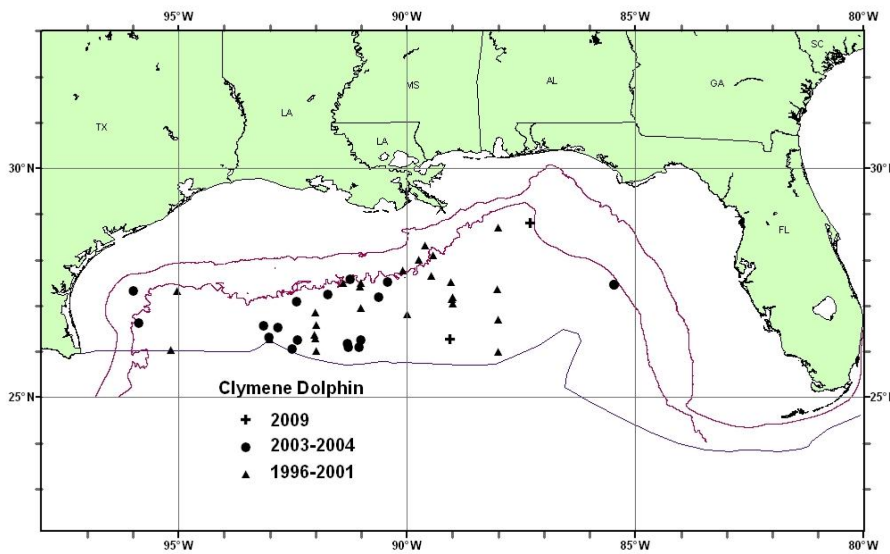

Figure 1. *Distribution of Clymene dolphin sightings from SEFSC shipboard ~~spring~~ surveys during spring 1996-2001, ~~and from~~ summer 2003 and spring 2004 ~~surveys~~, and summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

~~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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of~~ All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of Clymene dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 5,571 (CV=0.37) (Hansen *et al.* 1995), and for 1996 to 2001, 17,355 (CV=0.65) (Mullin and Fulling 2004; Table 1).

Clymene dolphins for all surveys combined was 5,571 (CV=0.37) (Hansen *et al.* 1995; Table 1).

Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 17,355 (CV=0.65) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for Clymene dolphins, pooled from 2003 to 2004, was 6,575 (CV=0.36) (Mullin 2007; Table 1).

Recent surveys and abundance estimates

During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for Clymene dolphins in oceanic waters, pooled from 2003 to 2004, was 6,575 (CV=0.36) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico. During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for Clymene dolphins in oceanic waters during 2009 was 129 (CV=1.00; Table 1).

Table 1. Summary of abundance estimates for northern Gulf of Mexico Clymene 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
Apr-Jun 1991-1994	Oceanic waters	5,571	0.37
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	17,355	0.65
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	6,575	0.36
Jun-Aug 2009	Oceanic waters	129	1.00

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 dolphins is 1296,575 (CV=1.000.36). The minimum population estimate for the northern Gulf of Mexico is 644,901 Clymene dolphins.

Current Population Trend

Four point estimates of Clymene dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of more than 100. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of Clymene dolphin abundance.There are insufficient data to determine the population trends for this species. The

~~pooled abundance estimate for 2003-2004 of 6,575 (CV=0.36) and that for 1996-2001 of 17,355 (CV=0.65) are significantly different (P<0.05). However, the 2003-2004 estimate is similar to that for 1991-1994 of 5,571 (CV=0.37). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of Clymene dolphin abundance. The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 644~~,901~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~“recovery”~~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 0.6~~49~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality or serious injury of Clymene dolphins during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Fisheries Information

~~The level of past or current, direct, human-caused mortality of Clymene dolphins in the northern Gulf of Mexico is unknown.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to Clymene dolphins by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). ~~.~~

Other Mortality

There were ~~3~~no reported strandings ~~events~~ of Clymene dolphins in the Gulf of Mexico during ~~1999-2007~~2006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008~~). ~~One animal stranded in Florida in July 2002, 2 animals mass stranded in Louisiana in September 2003, and 1 animal stranded in Texas in April 2004. No evidence of human interactions was detected 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see “Habitat Issues” below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. The total level of 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 human-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 (i.e., U.S. Gulf of Mexico) occur in oceanic waters (>200m) (Figure 1; Maze-Foley and Mullin 2006). 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).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), Fraser's dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico Fraser's dolphins is unknown (~~Mullin 2007;~~ Table 1). No sightings of groups of Fraser's dolphins were made during a summer 2009~~2003 and spring 2004~~ survey~~s~~. Nevertheless, a small number of Fraser's dolphins probably continually inhabit the northern Gulf of Mexico. Historically, sightings have been consistently made every 3-4 years since the early 1990's but have not occurred or have been rare during any given survey.

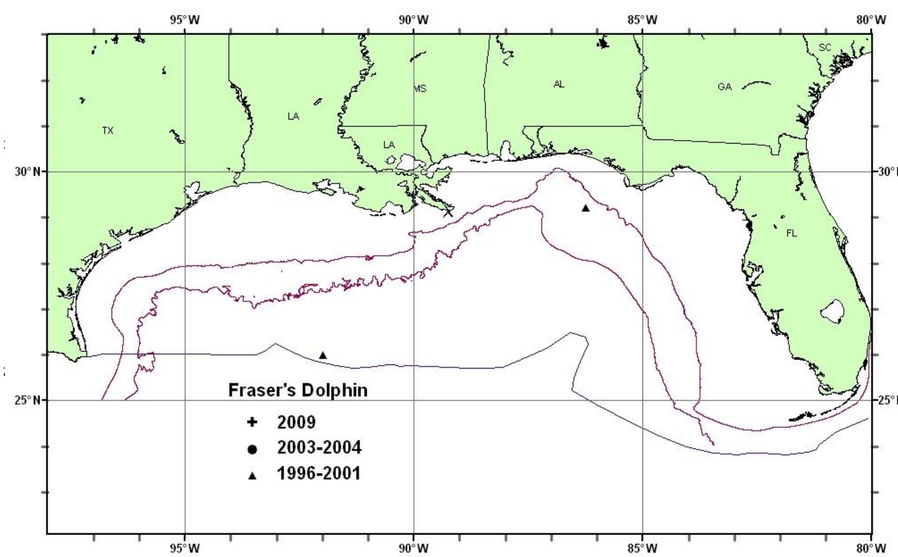

Figure 1. *Distribution of Fraser's dolphin sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004, and summer 2009 ~~surveys~~. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of Fraser's dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 127 (CV=0.90) (Hansen *et al.* 1995), and for 1996 to 2001, 726 (CV=0.70) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for Fraser's dolphins, pooled from 2003 to 2004, was 0 (Mullin 2007; Table 1).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). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of Fraser's dolphins for all surveys combined was 127 (CV= 0.90) (Hansen *et al.* 1995; Table 1). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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; Table 1).

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for Fraser's dolphins in oceanic waters during 2009 was 0 (Table 1). Because sightings of groups of Fraser's dolphins have historically been uncommon to rare, it is probable that Fraser's dolphins were in the northern Gulf of Mexico during 2009 but were not encountered.

During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for Fraser's dolphins in oceanic waters, pooled from 2003 to 2004, was 0 (Mullin 2007). Because sightings of groups of Fraser's dolphins have historically been uncommon to rare, it is probable that Fraser's dolphins were in the northern Gulf of Mexico during 2003 and 2004 but were not encountered. Therefore, the best available abundance estimate for this species in the northern Gulf of Mexico is unknown (Table 1).

Table 1. Summary of abundance estimates for northern Gulf of Mexico Fraser's 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
Apr-Jun 1991-1994	Oceanic waters	127	0.90
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	726	0.70
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	0	-
Jun-Aug 2009	Oceanic waters	0	-

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 unknown. The minimum population estimate for the northern Gulf of Mexico for Fraser's dolphins is unknown.

Current Population Trend

There are insufficient data to determine the population trends for this species. The best available abundance estimate is unknown. The pooled abundance estimate for 1996-2001 of 726 (CV=0.70) and that for 1991-1994 of 127 (CV=0.89) were not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. The large relative changes in the total abundances of Fraser's dolphin are probably due to a number of factors. Fraser's dolphin is most certainly a resident species in the Gulf of Mexico but probably occurs in low numbers and the survey effort is not sufficient to estimate the abundance of uncommon or rare species with precision. Also, these temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of Fraser's dolphin abundance. Fraser's dolphin, like all the other oceanic cetacean species in the Gulf, is a mobile predator and this stock is most likely a transboundary stock. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 undetermined.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a Fraser's dolphin during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Fisheries Information

~~The level of past or current, direct, human-caused mortality of Fraser's dolphins in the northern Gulf of Mexico is unknown.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to Fraser's dolphins by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Other Mortality

There ~~was 1~~were no reported strandings ~~event~~ of Fraser's dolphins in the Gulf of Mexico during 2006-2010~~1999-2007~~ (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008~~). ~~Ten animals mass stranded in Florida during April 2003. No evidence of human interactions was detected 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

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Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Despite an undetermined PBR, this is not a strategic stock because there is no documented human-related mortality and serious injury.

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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 (i.e., U.S. Gulf of Mexico) during 1921-1995 occurred primarily in oceanic waters ranging from 256 to 2,652 m (averaging 1,242m) in the north-central Gulf of Mexico (O'Sullivan and Mullin 1997). More recent sightings from NMFS vessel surveys have also occurred in oceanic waters of the north-central Gulf (Figure 1). 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; Maze-Foley and Mullin 2006) and recorded in May, August, September and November by earlier opportunistic ship-based sources (O'Sullivan and Mullin 1997).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), killer whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

Different stocks ~~were~~have been 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 in the northern Gulf of Mexico, 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

The best abundance estimate available for northern Gulf of Mexico killer whales is 28~~49~~ (CV=1.02~~0.77) (Mullin 2007~~; Table 1). This estimate is ~~pooled~~ from a summer 2009 ~~2003 and spring 2004~~ oceanic survey~~s~~ covering waters from the 200~~-~~m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~.

Earlier abundance estimates

All estimates of abundance were derived through the application of distance sampling analysis (Buckland *et al.* 2001) and the computer program

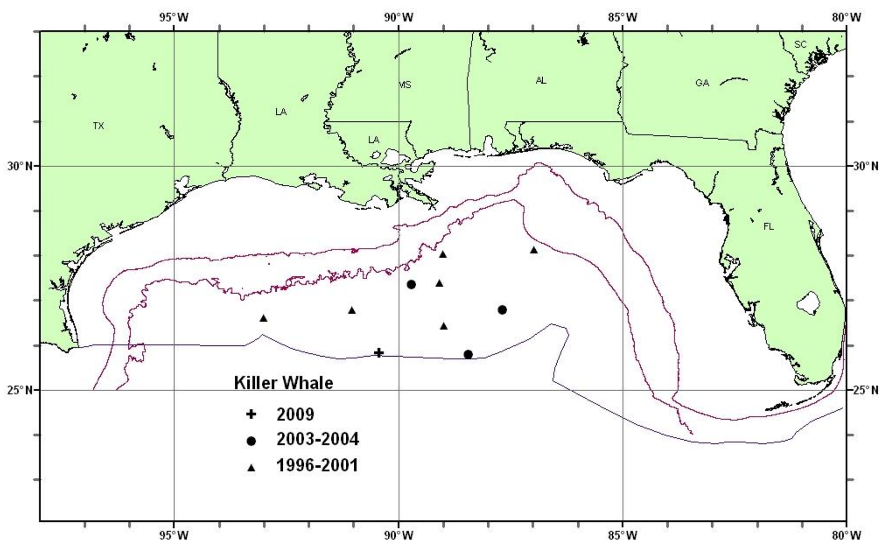

Figure 1. *Distribution of killer whale sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004, and summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100-m and 1,000-m isobaths and the offshore extent of the U.S. EEZ.*

DISTANCE (Thomas *et al.* 1998) to line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of killer whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 277 (CV=0.42) (Hansen *et al.* 1995), and for 1996 to 2001, 133 (CV=0.49) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for killer whales, pooled from 2003 to 2004, was 49 (CV=0.77) (Mullin 2007; Table 1).~~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 in conjunction with bluefin tuna ichthyoplankton surveys during summer in the northern Gulf of Mexico from the 200-m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of killer whales for all surveys combined was 277 (CV=0.42) (Hansen *et al.* 1995; Appendix IV). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 133 (CV=0.49) (Mullin and Fulling 2004; Appendix IV).~~

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico ~~using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for killer whales in oceanic waters during 2009 was 28 (CV=1.02; Table 1).~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for killer whales in oceanic waters, pooled from 2003 to 2004, was 49 (CV=0.77) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico.~~

Table 1. Summary of ~~recent~~ abundance estimates for northern Gulf of Mexico killer whales. 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
Apr-Jun 1991-1994	Oceanic waters	277	0.42
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	133	0.49
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	49	0.77
Jun-Aug 2009	Oceanic waters	28	1.02

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 28~~49~~ (CV=1.02~~0.77~~). The minimum population estimate for the northern Gulf of Mexico is 14~~28~~ killer whales.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 49 (CV=0.77) and that for 1996-2001 of 133 (CV=0.49) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. The abundance estimate for 1991-1994 was 277 (CV=0.42). The large relative changes in the total abundances of killer whales are probably due to a number of factors. The killer whale is most certainly a resident species in the Gulf of Mexico but probably occurs in low numbers and the survey effort is not sufficient to estimate the abundance of uncommon or rare species with precision. Also, these temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of killer whale abundance. The killer whale, like all the other oceanic cetacean species in the Gulf, is a mobile predator and this stock is most likely a transboundary stock. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 ~~28~~14. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~“recovery”~~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 0.1~~0.3~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a killer whale during 1998-~~2008~~2010 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2008 there was 1 killer whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Garrison *et al.* 2009).

Fisheries Information

~~The level of past or current, direct, human-caused mortality of killer whales in the northern Gulf of Mexico is unknown.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to killer whales by this fishery during 1998-2010 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, on 17 May 2008 there was 1 killer whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Garrison *et al.* 2009). This was the second observed interaction between a killer whale and this fishery and the first observed interaction within the Gulf of Mexico. During 15 April – 15 June 2008 observer coverage in the Gulf of Mexico was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. Resulting observer coverage for this time and area ~~is~~was dramatically higher than typical for previous years (Garrison *et al.* 2009).

Other Mortality

There were no reported strandings of killer whales in the Gulf of Mexico during ~~2004-2008~~2006-2010 (NOAA

National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011September 2008 and 21 September 2009). 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For oceanic dolphins the NOAA-led effortsFor continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-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 (i.e., U.S. Gulf of Mexico) occur in oceanic waters, primarily in the eastern Gulf (Figure 1; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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).

Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), false killer whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The current population size for the false killer whale in the northern Gulf of Mexico is unknown because the survey data are more than 8 years old (Wade and Angliss 1997).The best abundance estimate available for northern Gulf of Mexico false killer whales is 777 (CV=0.56) (Mullin 2007; Table 1). This estimate is pooled from summer 2003 and spring 2004 oceanic surveys covering waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ).

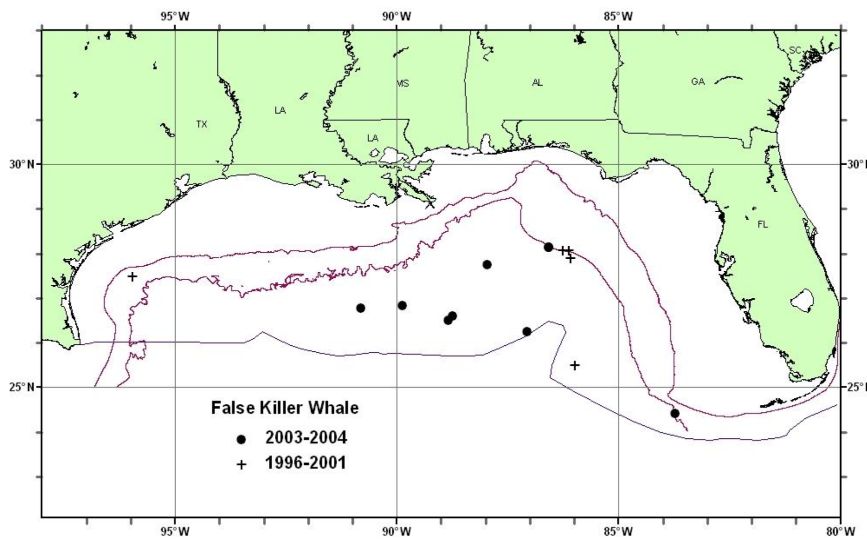

Figure 1. *Distribution of false killer whale sightings from SEFSC spring vessel surveys during spring 1996-2001, and from summer 2003 and spring 2004 surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier aAbundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of false killer whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 381 (CV=0.62) (Hansen *et al.* 1995), and for 1996 to 2001, 1038 (CV=0.71) (Mullin and Fulling 2004; Table 1).

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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of false killer whales for all surveys combined was 381 (CV=0.62) (Hansen *et al.* 1995; Table 1).

Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 1,038 (CV=0.71) (Mullin and Fulling 2004; Table 1).

Recent surveys and abundance estimates

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The most recent abundance estimate for false killer whales, pooled from 2003 to 2004, was 777 (CV=0.56) (Mullin 2007; Table 1).During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for false killer whales in oceanic waters, pooled from 2003 to 2004, was 777 (CV=0.56) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico. Because these data are more than 8 years old, the current best population estimate is unknown.

Recent survey

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. One group of false killer whales was sighted during the 2009 survey on an effort segment that was not included in the line-transect analysis. Therefore, false killer whale abundance could not be estimated from the 2009 survey.

Table 1. Summary of abundance estimates for northern Gulf of Mexico false killer whales. 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
Apr-Jun 1991-1994	Oceanic waters	381	0.62
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	1,038	0.71
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	777	0.56

Minimum Population Estimate

The minimum population estimate is unknown. 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 unknown777 (CV=0.56). The minimum population estimate for the northern Gulf of Mexico is unknown501 false killer whales.

Current Population Trend

Three point estimates of false killer whale abundance have been made based on data from surveys covering 1991-2004. The estimates vary by a maximum factor of nearly three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of false killer whale abundance.There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 777 (CV=0.56) and that for 1996-2001 of 1,038 (CV=0.71) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of false killer whale abundance. The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ. The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 (PBR) is undetermined. 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 unknown 501. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery"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 5.0.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality or serious injury of a false killer whale during 1998-20072010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Fisheries Information

The level of past or current, direct, human-caused mortality of false killer whales in the northern Gulf of Mexico is unknown. The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to false killer whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Other Mortality

There was 1were two reported strandinged of a false killer whales in the Gulf of Mexico during 1999-20072006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 September 2008November 2011). Two animals mass stranded in Florida during 2009. It could not be determined if there was evidence of human interactions. 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For oceanic dolphins the NOAA-led effortsFor continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-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 (i.e., U.S. Gulf of Mexico) occur in oceanic waters (Figure 1; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), pygmy killer whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico pygmy killer whales is 152323 (CV=1.020.60) (Mullin 2007; Table 1). This estimate is pooled from a summer 20092003 and spring 2004 oceanic surveys covering waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ).

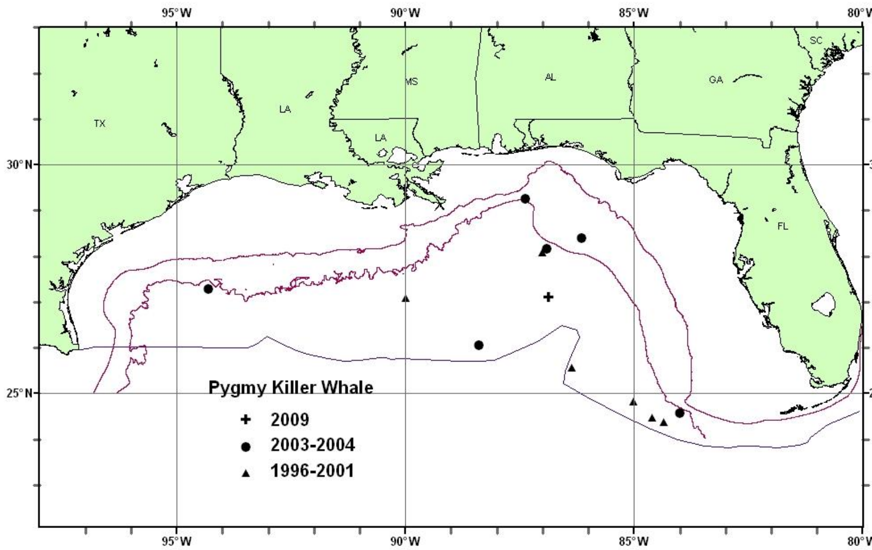

Figure 1. *Distribution of pygmy killer whale sightings from SEFSC spring vessel surveys during spring 1996-2001, and from summer 2003 and spring 2004, and summer 2009 surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of pygmy killer whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 518 (CV=0.81) (Hansen *et al.* 1995), and for 1996 to 2001, 408 (CV=0.60) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for pygmy killer whales, pooled from 2003 to 2004, was 323 (CV=0.60) (Mullin 2007; Table 1).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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of pygmy killer whales for all surveys combined was 518 (CV=0.81) (Hansen *et al.* 1995; Table 1). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 408 (CV=0.60) (Mullin and Fulling 2004; Table 1).

Recent surveys and abundance estimates

During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for pygmy killer whales in oceanic waters, pooled from 2003 to 2004, was 323 (CV=0.60) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico. During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for pygmy killer whales in oceanic waters during 2009 was 152 (CV=1.02; Table 1).

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 323 (CV=0.60). The minimum population estimate for the northern Gulf of Mexico is 203 pygmy killer whales.

Table 1. Summary of abundance estimates for northern Gulf of Mexico pygmy killer whales. 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
Apr-Jun 1991-1994	Oceanic waters	518	0.81
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	408	0.60
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	323	0.60
Jun-Aug 2009	Oceanic waters	152	1.02

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 152 (CV=1.02). The minimum population estimate for the northern Gulf of Mexico is 75 pygmy killer whales.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 323 (CV=0.60) and that for 1996-2001 of 408 (CV=0.60) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. These estimates are generally

~~similar to that for 1991-1994 of 518 (CV=0.81). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of pygmy killer whale abundance.~~ Four point estimates of pygmy killer whale abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of more than three. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of pygmy killer whale abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 75~~203~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 0.8~~2.0~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a pygmy killer whale during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

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). The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to pygmy killer whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Other Mortality

There were ~~2~~4 reported strandings of ~~a~~ pygmy killer whales in the Gulf of Mexico during ~~1999-2007~~2006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 ~~September~~November 20~~08~~11). ~~One pygmy killer whale stranded in Florida in 2001, and 1 stranded in Texas in 2004~~Four pygmy killer whales stranded in 2008 (2 animals mass stranded in Florida, 1 in Mississippi, 1 in Texas). ~~No e~~Evidence of human interaction~~s~~ was detected for 1 of these stranded animals. A plastic, office sheet protector was crumpled up and lodged in the esophagus of the animal. For 2 stranded animals, it could not be determined if there was evidence of human interactions, and for the remaining stranded animal, no evidence of human interaction was detected. 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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~~November 2008~~~~December 2011~~April 2012

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 (i.e., U.S. Gulf of Mexico) occur primarily in oceanic waters (Figure 1; Mullin *et al.* 1991; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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. Diagnostic morphological characters have also been useful in distinguishing the 2 *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 2 *Kogia* species when such measurements are obtainable (Barros and Duffield 2003).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), dwarf sperm whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico dwarf and pygmy sperm whales is 186~~453~~ (CV=1.04~~0.35);~~ ~~(Mullin 2007;~~ Table 1). This estimate is ~~pooled~~ from a summer ~~2003 and spring 2004~~2009 oceanic survey~~s~~ covering waters from the 200m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~.

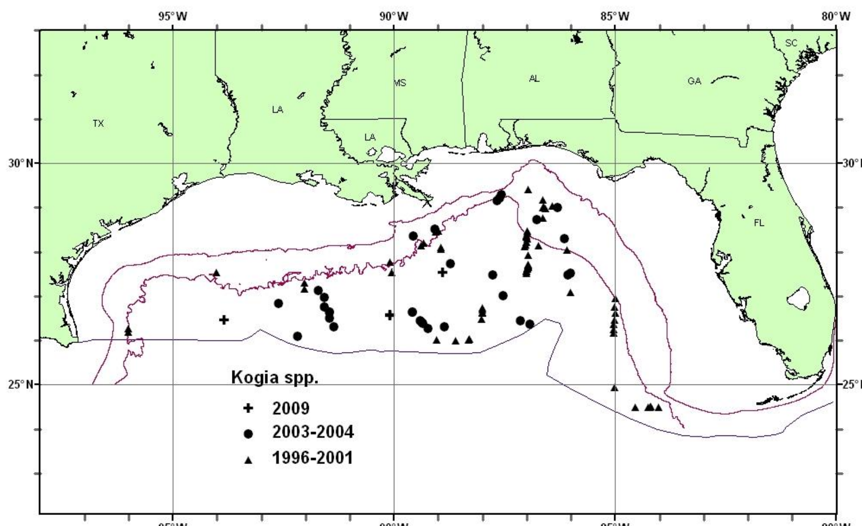

Figure 1. *Distribution of dwarf and pygmy sperm whale sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004~~ surveys~~, and summer 2009. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

~~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.~~ All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of dwarf and pygmy sperm whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 547 (CV=0.28) (Hansen *et al.* 1995), and for 1996 to 2001, 742 (CV=0.29) (Mullin and Fulling 2004; Table 1).~~From 1991 through 1994, line-transect vessel surveys were conducted in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. 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; Table 1). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 742 (CV=0.29) (Mullin and Fulling 2004; Table 1).~~ A separate estimate of abundance for dwarf sperm whales could not be estimated due to uncertainty of species identification at sea.

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The estimate of abundance for dwarf and pygmy sperm whales in oceanic waters, pooled from 2003 to 2004, was 453 (CV=0.35) (Mullin 2007; Table 1).

Recent surveys and abundance estimates

~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for dwarf and pygmy sperm whales in oceanic waters, pooled from 2003 to 2004, was 453 (CV=0.35) (Mullin 2007; Table 1), which is the best available abundance estimate for these species in the northern Gulf of Mexico.~~ During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico ~~using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for dwarf and pygmy sperm whales in oceanic waters during 2009 was 186 (CV=1.04; Table 1).

Table 1. Summary of combined ~~-~~abundance estimates for northern Gulf of Mexico dwarf and pygmy sperm whales. 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
Apr-Jun 1991-1994	Oceanic waters	547	0.28
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	742	0.29
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	453	0.35
Jun-Aug 2009	Oceanic waters	186	1.04

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 186~~453~~ (CV=1.04~~0.35~~). 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 90~~340~~ dwarf and pygmy sperm whales.

Current Population Trend

There are insufficient data to determine the population trends for this species due to uncertainty in species identification at sea. ~~The pooled abundance estimate for *Kogia* spp. for 2003-2004 of 453 (CV=0.35) and that for 1996-2001 of 742 (CV=0.29) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. The abundance estimate for *Kogia* spp. for 1991-1994 was 547 (CV=0.28). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of *Kogia* abundance.~~ Four point estimates of *Kogia* spp. abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly four. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of *Kogia* abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 90~~340~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 dwarf and pygmy sperm whales is 0.9~~3.4~~. 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-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Fisheries Information

~~The level of past or current, direct, human-caused mortality of dwarf sperm whales in the northern Gulf of Mexico is unknown.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to dwarf sperm whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).
~~.~~

Other Mortality

At least 9~~17~~ dwarf sperm whale strandings were documented in the northern Gulf of Mexico during 2006-2010~~from 1999 through 2007~~ (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008; Table 2 displays 2003-2007 data~~). ~~No e~~Evidence of human interaction~~s~~s was detected for 1 of these stranded animals; no evidence of human interactions was detected for 6 animals; for 2 animals, it could not be determined if there was evidence of human interactions. An additional ~~9~~3 *Kogia* spp. stranded during 2006-2010~~1999-2007 (2 in Texas in 2000, 1 in Texas in 2001, 2 in Texas in 2002, 1 in Mississippi in 2003, 1 in Florida in 2003, 1 in Florida in 2004, and 1 in Florida in 2006)~~. Evidence of human interactions was detected for 1 of the~~se~~ *Kogia* sp. strand~~ed animals~~ings; it could not be determined if there was evidence of human interactions for the remaining 2 *Kogia* sp. strandings. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see “Habitat Issues” below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

~~Table 2. Dwarf sperm whale (*Kogia sima*) strandings along the northern Gulf of Mexico coast, 2003-2007.~~

~~STATE~~	~~2003~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	~~TOTAL~~
~~Alabama~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Florida~~	~~1~~[a]	~~1~~[c]	~~1~~	~~2~~[d,e]	~~2~~	~~7~~
~~Louisiana~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Mississippi~~	~~0~~[b]	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Texas~~	~~0~~	~~2~~	~~0~~	~~0~~	~~2~~[f]	~~4~~
~~TOTAL~~	~~1~~	~~3~~	~~1~~	~~2~~	~~4~~	~~11~~

~~[a] 1 additional *Kogia* sp. stranded~~
~~[b] 1 additional *Kogia* sp. stranded~~
~~[c] 1 additional *Kogia* sp. stranded~~
~~[d] 1 additional *Kogia* sp. stranded~~
~~[e] Previously reported incorrectly as 1 stranded animal~~
~~[f] Mass stranding of 2 animals in August 2007~~

Table 2. Dwarf sperm whale (*Kogia sima*) strandings along the northern Gulf of Mexico coast, 2006-2010.

STATE	2006	2007	2008	2009	2010	TOTAL
Alabama	0	0	0	0[e]	0	0
Florida	2[a,b]	2	0	1[f]	0	5
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	0	2[c]	2[d]	0	0	4
TOTAL	2	4	2	1	0	9

[a] 1 additional *Kogia* sp. stranded
[b] Previously reported incorrectly as 1 stranded animal
[c] Mass stranding of 2 animals in August 2007
[d] A mom/calf pair stranding together

[e] 1 *Kogia* sp. stranded
[f] 1 additional *Kogia* sp. stranded

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Despite an unknown PBR for this species, this is not a strategic stock because it is assumed that average annual human-related mortality and serious injury does not exceed combined PBR for dwarf and pygmy sperm whales. However, the continuing inability to distinguish between species of *Kogia* raises concerns about the possibility of mortalities of 1 stock or the other exceeding 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; Bloodworth and Odell 2008). Sightings of these animals in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) occur primarily in oceanic waters (Figure 1; Mullin *et al.* 1991; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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. Diagnostic morphological characters have also been useful in distinguishing the 2 *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 2 *Kogia* species when such measurements are obtainable (Barros and Duffield 2003).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), pygmy sperm whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico pygmy and dwarf sperm whales is 186453 (CV=1.040.35); (Mullin 2007; Table 1). This estimate is pooled from a summer 2009 2003 and spring 2004 oceanic surveys covering waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ).

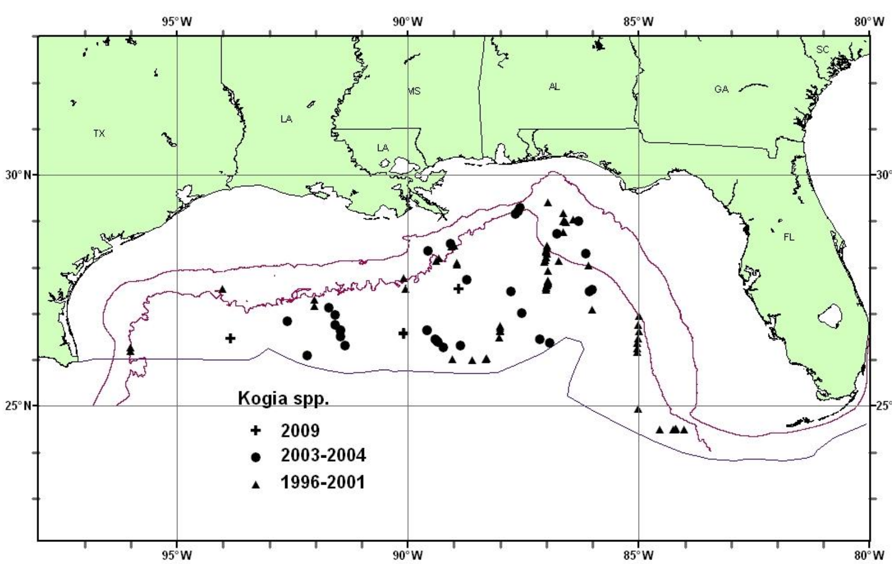

Figure 1. *Distribution of pygmy and dwarf sperm whale sightings from SEFSC spring vessel surveys during spring 1996-2001, and from summer 2003 and spring 2004, and summer 2009 surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. 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; Table 1).

Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 742 (CV=0.29) (Mullin and Fulling 2004; Table 1). A separate estimate of abundance for pygmy sperm whales could not be estimated due to uncertainty of species identification at sea.

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of dwarf and pygmy sperm whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 547 (CV=0.28) (Hansen *et al.* 1995), and for 1996 to 2001, 742 (CV=0.29) (Mullin and Fulling 2004; Table 1). A separate estimate of abundance for pygmy sperm whales could not be estimated due to uncertainty of species identification at sea.

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The estimate of abundance for dwarf and pygmy sperm whales in oceanic waters, pooled from 2003 to 2004, was 453 (CV=0.35) (Mullin 2007; Table 1).

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The estimate of abundance for dwarf and pygmy sperm whales in oceanic waters during 2009 was 186 (CV=1.04; Table 1). During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for pygmy and dwarf sperm whales in oceanic waters, pooled from 2003 to 2004, was 453 (CV=0.35) (Mullin 2007; Table 1), which is the best available abundance estimate for these species in the northern Gulf of Mexico.

Table 1. Summary of combined abundance estimates for northern Gulf of Mexico pygmy and dwarf sperm whales. 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
Apr-Jun 1991-1994	Oceanic waters	547	0.28
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	742	0.29
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	453	0.35
Jun-Aug 2009	Oceanic waters	186	1.04

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 186453 (CV=1.040.35). 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 90~~340~~ pygmy and dwarf sperm whales.

Current Population Trend

There are insufficient data to determine the population trends for this species due to uncertainty in species identification at sea. ~~The pooled abundance estimate for *Kogia* spp. for 2003-2004 of 453 (CV=0.35) and that for 1996-2001 of 742 (CV=0.29) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. The abundance estimate for *Kogia* spp. for 1991-1994 was 547 (CV=0.28). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of *Kogia* abundance.~~ Four point estimates of *Kogia* spp. abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly four. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of *Kogia* abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 90~~340~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 0.9~~3.4~~. It is not possible to determine the PBR for only pygmy sperm whales.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury to this stock during 2006-2010 was 0.3 pygmy sperm whales (CV=1.0; Table 2). ~~There has been no reported fishing-related mortality of dwarf or pygmy sperm whales during 1998-2007 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008).~~

Fisheries Information

The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). ~~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 northern Gulf of Mexico. There were no reports of mortality or serious injury to ~~dwarf~~pygmy sperm whales by this fishery during 1998-2009 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010); however, during 2010, 1 mortality of a pygmy sperm whale (a portion of the carcass was retrieved and species identification was confirmed through genetic analyses) was observed during quarter 2 and estimated mortalities attributable to the pelagic longline fishery in the Gulf of Mexico region during quarter 2 were 1.2 (CV=1.00; Garrison and Stokes 2011). The total estimated mortality for 2010 was 1.2 animals (CV=1.0). The annual average serious injury and mortality attributable to the Gulf of Mexico pelagic longline fishery for the 5-year period from

2006 to 2010 was 0.3 animals (CV=1.0; Table 2).

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico pygmy sperm whale (*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[a]	Data Type[b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	06-10	47, 55, 53, 47, 46	Obs. Data Logbook	.08, .14, .25, .21, .26	0,0,0,0,0	0,0,0,0,1	0,0,0,0,0	0,0,0,0,1.4	0,0,0,0,1.4	NA, NA, NA, NA,1.0	0.3 (1.0)
TOTAL											0.3 (1.0)

a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.

Other Mortality

At least ~~18~~14 pygmy sperm whale strandings were documented in the northern Gulf of Mexico during 2006-2010~~1999-2007~~ (Table 3; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011~~September 2008; Table 2 displays 2003-2007 data~~). For 7 of the strandings, no evidence of human interactions was detected, and for the remaining 7, it could not be determined if there was evidence of human interactions. An additional 3 *Kogia* spp. stranded during 2006-2010. ~~Two animals mass stranded in Florida during January 2001. No evidence of human interactions was detected for these stranded animals. An additional 9 *Kogia* spp. stranded during 1999-2007 (2 in Texas in 2000, 1 in Texas in 2001, 2 in Texas in 2002, 1 in Mississippi in 2003, 1 in Florida in 2003, 1 in Florida in 2004, and 1 in Florida in 2006).~~ Evidence of human interactions was detected for 1 of the~~se~~ *Kogia* sp. strand~~ed animals~~ings; it could not be determined if there was evidence of human interactions for the remaining 2 *Kogia* sp. strandings. Stranding data probably underestimate the extent of fishery-related mortality and serious injury because not all of the marine mammals which die or are seriously injured 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, 1 animal from this stock was considered to be part of the UME.

~~Table 2. Pygmy sperm whale (*Kogia breviceps*) strandings along the northern Gulf of Mexico coast, 2003-2007.~~

~~STATE~~	~~2003~~	~~2004~~	~~2005~~	~~2006~~	~~2007~~	~~TOTAL~~
~~Alabama~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Florida~~	~~3~~[a]	~~1~~[c]	~~0~~	~~1~~[d]	~~1~~	~~6~~
~~Louisiana~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~

~~Mississippi~~	~~0[b]~~	~~0~~	~~0~~	~~0~~	~~0~~	~~0~~
~~Texas~~	~~1~~	~~0~~	~~2~~	~~1~~	~~0~~	~~4~~
~~**TOTAL**~~	~~4~~	~~1~~	~~2~~	~~2~~	~~1~~	~~10~~

~~[a] 1 additional *Kogia* sp. stranded~~
~~[b] 1 additional *Kogia* sp. stranded~~
~~[c] 1 additional *Kogia* sp. stranded~~
~~[d] 1 additional *Kogia* sp. stranded~~

Table 3. Pygmy sperm whale (*Kogia breviceps*) strandings along the northern Gulf of Mexico coast, 2006-2010.

STATE	**2006**	**2007**	**2008**	**2009**	**2010**	**TOTAL**
Alabama	0	0	0	0[b]	0	0
Florida	1[a]	1	2	3[c,d]	0	7
Louisiana	0	0	0	0	1*	1
Mississippi	0	0	0	0	0	0
Texas	1	0	3	2	0	6
TOTAL	2	1	5	5	1	14

[a] 1 additional *Kogia* sp. stranded
[b] 1 *Kogia* sp. stranded
[c] Two of the animals were a mom/calf pair stranding together
[d] 1 additional *Kogia* sp. stranded
*This stranding is included in the Northern Gulf of Mexico UME

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Despite an unknown PBR for this species, this is not a strategic stock because it is assumed that average annual human-related mortality and serious injury does not exceed combined PBR for dwarf and pygmy sperm whales. However, the continuing inability to distinguish between species of *Kogia* raises concerns about the possibility of mortalities of 1 stock or the other exceeding 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.* 19942008). Sightings in the northern Gulf of Mexico (i.e., U.S. Gulf of Mexico) have generally occurred in water depths >800m and west of Mobile Bay, Alabama (Figure 1; Mullin *et al.* 1994; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Ortega Ortiz 2002), melon-headed whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

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

The best abundance estimate available for northern Gulf of Mexico melon-headed whales is 2,2352,283 (CV=0.750.76) (Mullin 2007; Table 1). This estimate is pooled from a summer 20092003 and spring 2004 oceanic surveys covering waters from the 200m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ).

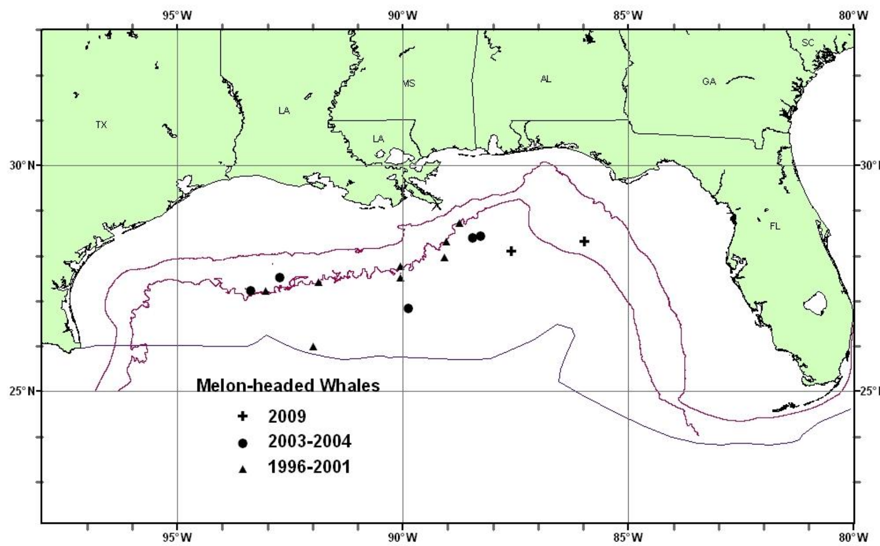

Figure 1. *Distribution of melon-headed whale sightings from SEFSC spring vessel surveys during spring 1996-2001, and from summer 2003 and spring 2004, and summer 2009 surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of melon-headed whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 3,965 (CV=0.39) (Hansen *et al.* 1995), and for 1996 to 2001, 3,451 (CV=0.55) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for melon-headed whales, pooled from 2003 to 2004, was 2,283 (CV=0.76) (Mullin 2007; Table 1).~~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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of melon-headed whales for all surveys combined was 3,965 (CV=0.39) (Hansen *et al.* 1995; Table 1). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 3,451 (CV=0.55) (Mullin and Fulling 2004; Table 1).~~

Recent surveys and abundance estimates

During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico~~ using NOAA Ship *Gordon Gunter*~~. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for melon-headed whales in oceanic waters during 2009 was 2,235 (CV=0.75; Table 1).~~During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).~~

~~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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for melon-headed whales in oceanic waters, pooled from 2003 to 2004, was 2,283 (CV=0.76) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico.~~

Table 1. Summary of abundance estimates for northern Gulf of Mexico melon-headed whales. 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
Apr-Jun 1991-1994	Oceanic waters	3,965	0.39
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	3,451	0.55
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	2,283	0.76
Jun-Aug 2009	Oceanic waters	2,235	0.75

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 2,235~~2,283~~ (CV=0.75~~0.76~~). The minimum population estimate for the northern Gulf of Mexico is 1,274~~1,293~~ melon-headed whales.

Current Population Trend

~~There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003 to 2004 of 2,283 (CV=0.76) and that for 1996-2001 of 3,451 (CV=0.55) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is low. These estimates are generally similar to that for 1991-1994 of 3,965 (CV=0.39). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of melon-headed whale abundance~~ Four point estimates of melon-headed whale abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly two. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of melon-headed whale abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 1,274~~1,293~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 13~~13~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality of a melon-headed whale during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

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). The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no reports of mortality or serious injury to melon-headed whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011).

Other Mortality

There were 11~~10~~ reported strandings of melon-headed whales in the Gulf of Mexico during ~~1999-2007~~2006-2010 (Table 2; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011 ~~September 2008; Table 2 displays 2003-2007 data~~). No evidence of human interactions was detected for 6 of these stranded animals, and for the remaining 5, it could not be determined if there was 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 ~~February 2010, and as of~~ February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During

2010, 2 animals from this stock were considered to be part of the UME.

Table 2. Melon-headed whale (*Peponocephala electra*) strandings along the northern Gulf of Mexico coast, 2003-2007.

STATE	2003[a]	2004	2005	2006	2007	TOTAL
Alabama	0	0	0	0	0	0
Florida	2	0	0	0	0	2
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	1	1	0	1	2	5
TOTAL	3	1	0	1	2	7

[a] Strandings from 2003 were previously reported incorrectly. Previous reports listed 2 strandings in Alabama and 2 in Texas, for a total of 4 strandings in 2003.

Table 2. Melon-headed whale (*Peponocephala electra*) strandings along the northern Gulf of Mexico coast, 2006-2010.

STATE	2006	2007	2008	2009	2010	TOTAL
Alabama	0	0	0	0	1*	1
Florida	0	0	0	0	0	0
Louisiana	0	0	0	0	1*	1
Mississippi	0	0	0	0	0	0
Texas	1	2	1	0	5	9
TOTAL	1	2	1	0	7	11

* This stranding is included in the Northern Gulf of Mexico UME

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For oceanic dolphins the NOAA-led effortsFor continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known but none has been documented. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-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 (i.e., U.S. Gulf of Mexico) occur throughout oceanic waters but are concentrated in continental slope waters (Figure 1; Baumgartner 1997; Maze-Foley and Mullin 2006). 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).

Although there are only a few records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), Risso's dolphins almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

The Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently little information to differentiate this stock from the Atlantic Ocean stock(s). In 2006, a Risso's dolphin that stranded on the Florida Gulf Coast was rehabilitated, satellite tagged and released into the Gulf southwest of Tampa Bay. Over a 23-day period the Risso's dolphin moved from the Gulf release site into the Atlantic Ocean and north to just off of Delaware (Wells *et al.* 2009). During September 2007 – January 2008, tracking of an adult female Risso's dolphin that had been rehabilitated and released by Mote Marine Laboratory after stranding on the southwest coast of Florida documented movements throughout the northern Gulf of Mexico. The dolphin, released with its young calf, traveled as far as Bahia de Campeche, Mexico, and waters off Texas and Louisiana before returning to the shelf edge southwest of its stranding site off Florida (Wells *et al.* 2008a). Additional morphological, genetic and/or behavioral data are needed to provide further information on stock delineation.

POPULATION SIZE

The best abundance estimate available for northern Gulf of Mexico Risso's dolphins is 2,4421,589 (CV=0.570.27) (Mullin 2007; Table 1). This estimate is pooled from a summer 20092003 and spring 2004 oceanic surveys covering waters from the 200-m isobath to the seaward extent of the U.S. Exclusive Economic Zone (EEZ).

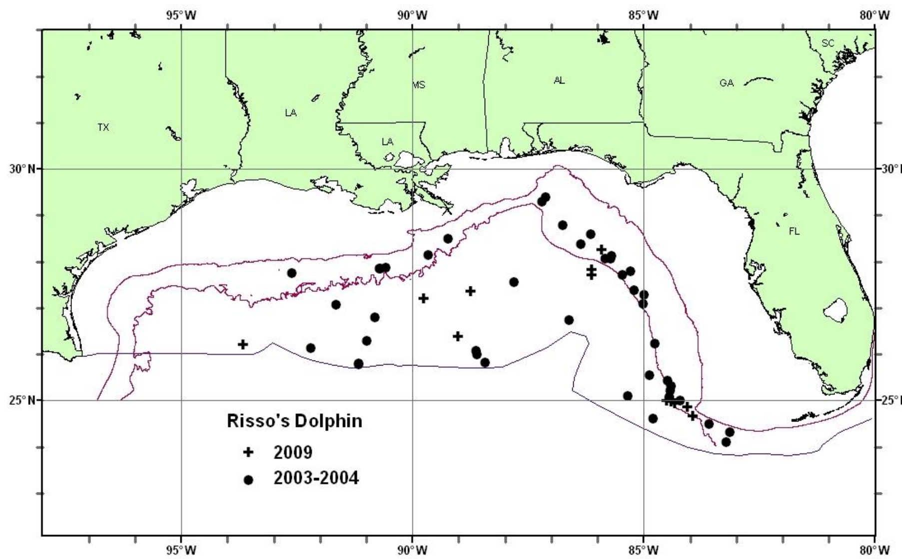

Figure 1. *Distribution of Risso's dolphin sightings from SEFSC vessel surveys during 1996-2001 and from summer 2003 and spring 2004, and during summer 2009 surveys. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100-m and 1,000-m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent of the U.S. EEZ), and are summarized of the

U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of Risso's dolphins for all surveys combined was estimated. For 1991 to 1994, the estimate was 2,749 (CV=0.27) (Hansen *et al.* 1995), and for 1996 to 2001, 2,169 (CV=0.32) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for Risso's dolphins, pooled from 2003 to 2004, was 1,589 (CV=0.27) (Mullin 2007; Table 1).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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200-m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of Risso's dolphins for all surveys combined was 2,749 (CV=0.27) (Hansen *et al.* 1995; Appendix IV). Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 2,169 (CV=0.32) (Mullin and Fulling 2004; Appendix IV).

Recent surveys and abundance estimates

During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200-m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for Risso's dolphins in oceanic waters, pooled from 2003 to 2004, was 1,589 (CV=0.27) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico. During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for Risso's dolphins in oceanic waters during 2009 was 2,442 (CV=0.57; Table 1).

Table 1. Summary of recent abundance estimate for northern Gulf of Mexico Risso's 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
Apr-Jun 1991-1994	Oceanic waters	2,749	0.27
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	2,169	0.32
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	1,589	0.27
Jun-Aug 2009	Oceanic waters	2,442	0.57

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 2,4421,589 (CV=0.570.27). The minimum population estimate for the northern Gulf of Mexico is 1,5631,271 Risso's dolphins.

Current Population Trend

~~There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 1,589 (CV=0.27) and that for 1996-2001 of 1,777 (CV=0.34) are not significantly different (P>0.05), but due to the precision of the estimates, the power to detect a difference is relatively low. These estimates are generally similar to that for 1991-1994 of 2,749 (CV=0.27). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of Risso's dolphin abundance.~~ Four point estimates of Risso's dolphin abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly two. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of Risso's dolphin abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The 2 cases of satellite-linked tracking of Risso's dolphins in the Gulf of Mexico both showed movements out of the U.S. Gulf of Mexico EEZ (Wells *et al.* 2008a, 2009). The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 1,563~~1,271~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 16~~13~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

The estimated annual average fishery-related mortality or serious injury for this stock during 2006-2010 is 1.7 Risso's dolphins (CV=0.63; Table 2). ~~There was one reported fishing-related mortality and 2 serious injuries of Risso's dolphins during 2008 (Garrison *et al.* 2009). The mortality and serious injuries were the result of entanglement interactions with the pelagic longline fishery. There was no reported fishing-related mortality of a Risso's dolphin during 1998-2007 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008). During 2005 there was 1 Risso's dolphin released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Fairfield Walsh and Garrison 2006).~~

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. pelagic longline fishery in the northern Gulf of Mexico and in the U.S. Atlantic (Lee *et al.* 1994).~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico ~~(see Appendix III for a description of the large pelagics longline fishery)~~. There were no reports of mortality or serious injury to Risso's dolphins in the northern Gulf of Mexico by this fishery during 1998-2007 or during 2009-2010 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison

2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison and Stokes 2010; 2011). Between 2006 and 2010, 1 mortality and 2 serious injuries of Risso’s dolphins were observed during interactions with the pelagic longline fishery. These interactions occurred during the first and second quarters of 2008 (Table 2; Garrison *et al.* 2009; Garrison and Stokes 2010; Garrison and Stokes 2011). For the 5-year period, the estimated annual combined serious injury and mortality attributable to the pelagic longline fishery in the northern Gulf of Mexico was 1.7 (CV=0.63). During 15 April – 15 June, in 2008-2010, observer coverage in the Gulf of Mexico was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. Resulting observer coverage for this time and area is very high (approaching 55%). Therefore, the high observer coverage during 2008-2010 primarily reflects high coverage rates during the second quarter of the year.~~During 2008, one mortality and two serious injuries occurred due to entanglement interactions with the pelagic longline fishery. Estimated annual mortality attributable to the pelagic longline fishery in the northern Gulf of Mexico during 2008 was 4.4 (CV=1.00) Risso’s dolphins and estimated annual serious injury was 3.9 (CV=0.72) Risso’s dolphins (Garrison *et al.* 2009). Observer coverage during quarter 1 when the mortality was observed was 21.6%, and coverage during quarter 2 when the serious injuries were observed was 58.2%. Overall percentage observer coverage for the Gulf of Mexico during 2008 was 27.0% (Garrison *et al.* 2009). During 15 April – 15 June 2008 observer coverage in the Gulf of Mexico was greatly enhanced to collect more robust information on the interactions between pelagic longline vessels and spawning bluefin tuna. Resulting observer coverage for this time and area is dramatically higher than typical for previous years. There were no reports of mortality or serious injury to Risso’s dolphins in the northern Gulf of Mexico by this fishery during 1998-2007 (Yeung 1999; 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008). However, d~~During 2005, ~~1~~1 Risso’s dolphin was observed entangled and released alive in the northern Gulf of Mexico. The animal was not hooked, but was tangled with mainline and leader around its flukes. All gear was removed and the animal dove immediately. It is presumed to have not been seriously injured (Fairfield Walsh and Garrison 2006). ~~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 northern Gulf of Mexico during 1993 (SEFSC, unpublished data). Estimated average annual fishery-related mortality and serious injury attributable to the pelagic longline fishery in the northern Gulf of Mexico during 1992-1993 was 19 Risso’s dolphins (CV=0.20).~~ There is a high likelihood that releases of dolphins that have ingested gear or with multi-wrap entanglements of appendages near their insertions will lead to mortality (Wells *et al.* 2008b).

Table 2. Summary of the incidental mortality and serious injury of northern Gulf of Mexico Risso’s dolphins by commercial fishery including the years sampled (Years), the number of vessels active within the fishery (Vessels), the type of data used (Data Type), the annual observer coverage (Observer Coverage), the observed mortalities and serious injuries recorded by on-board observers, the estimated annual mortality and serious injury, the combined annual estimates of mortality and serious injury (Estimated Combined Mortality), the estimated CV of the combined estimates (Estimated CVs) and the mean of the combined estimates (CV in parentheses).

Fishery	Years	Vessels[a]	Data Type[b]	Observer Coverage	Observed Serious Injury	Observed Mortality	Estimated Serious Injury	Estimated Mortality	Estimated Combined Mortality	Est. CVs	Mean Annual Mortality
Pelagic Longline	06-10	47, 55, 53, 47, 46	Obs. Data Logbook	.08, .14, .25, .21, .26	0,0,2,0,0	0,0,1,0,0	0,0,3.9,0,0	0,0,4.4,0,0	0,0,8.3,0,0	NA,NA,.63,NA,NA	1.7 (0.63)
TOTAL											1.7 (0.63)

a. Number of vessels in the fishery is based on vessels reporting effort to the pelagic longline logbook.
b. Observer data (Obs. Data) are used to measure bycatch rates, and the data are collected within the Northeast Fisheries Observer Program. Mandatory logbook data were used to measure total effort for the longline fishery. These data are collected at the Southeast Fisheries Science Center (SEFSC). Observer coverage in the GOM is dominated by very high coverage rates during April-June associated with efforts to improve estimates of Bluefin Tuna bycatch.

Other Mortality

There were 1410 reported strandings of Risso's dolphins in the Gulf of Mexico during 2004-20082006-2010 (Table 32; NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011 September 2008 and 21 September 2009). This includes 1 mass stranding of 5 animals in Florida during July 2005 (1 was rehabilitated and released by Mote Marine Laboratory), and 1one mass stranding of 4 animals in Florida during May 2007 (2 were rehabilitated and released by Mote Marine Laboratory) and one mass stranding of 2 animals in Florida during January 2009. No evidence of human interactions was detected for 2any of the stranded animals, and it could not be determined if there was evidence of human interactions for the remaining 8 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.

In 1992, with the enactment of the Marine Mammal Health and Stranding Response Act, the Working Group on Marine Mammal Unusual Mortality Events was created to determine when an unusual mortality event (UME) is occurring, and then to direct responses to such events. Since 1992, 8 UMEs have been declared in the Gulf of MexicoSince 1990, there have been 12 bottlenose dolphin die-offs or Unusual Mortality Events (UMEs) in the northern Gulf of Mexico, and 1 of these included a Risso's dolphin. Between August 1999 and May 2000, 152 bottlenose dolphins died coincident with *Karenia brevis* blooms and fish kills in the Florida Panhandle. Additional strandings included 3 Atlantic spotted dolphins, *Stenella frontalis*, 1 Risso's dolphin, 2 Blainville's beaked whales, *Mesoplodon densirostris*, and 4 unidentified dolphins. An UME was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

Table 2. Risso's dolphin (*Grampus griseus*) strandings along the northern Gulf of Mexico coast, 2004-2008.

STATE	2004	2005	2006	2007	2008	TOTAL
Alabama	0	0	0	0	0	0
Florida	1	5[a]	0	6[b]	0	12
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0
Texas	1	1	0	0	0	2
TOTAL	2	6	0	6	0	14

[a] Florida mass stranding of 5 animals in July 2005
[b] Includes Florida mass stranding of 4 animals in May 2007

Table 3. Risso's dolphin (*Grampus griseus*) strandings along the northern Gulf of Mexico coast, 2006-2010.

STATE	2006	2007	2008	2009	2010	TOTAL
Alabama	0	0	0	0	0	0
Florida	0	6[a]	0	2[b]	0	8
Louisiana	0	0	0	0	0	0
Mississippi	0	0	0	0	1	1
Texas	0	0	0	1	0	1
TOTAL	0	6	0	3	1	10

[a] Includes Florida mass stranding of 4 animals in May 2007
[b] Includes Florida mass stranding of 2 animals in January 2009

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. ~~For oceanic dolphins the NOAA-led efforts~~For continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-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 (i.e., U.S. Gulf of Mexico) occur primarily on the continental slope west of 89˚W (Figure 1; Mullin and Fulling 2004; Maze-Foley and Mullin 2006). 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).

Because there are many confirmed records from Gulf of Mexico waters beyond U.S. boundaries (e.g., Jefferson and Schiro 1997, Ortega Ortiz 2002), short-finned pilot whales almost certainly occur throughout the oceanic Gulf of Mexico (Jefferson *et al.* 2008), which is also composed of waters belonging to Mexico and Cuba where there is currently little information on cetacean species abundance and distribution. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. Exclusive Economic Zone (EEZ).

The Gulf of Mexico population is 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

The best abundance estimate available for northern Gulf of Mexico short-finned pilot whales is 2,415~~716~~ (CV=0.66~~0.34)~~ ~~(Mullin 2007~~; Table 1). This estimate is ~~pooled~~ from a summer 2009~~2003 and spring 2004~~ oceanic survey~~s~~ covering waters from the 200m isobath to the seaward extent of the U.S. ~~Exclusive Economic Zone (~~EEZ~~)~~.

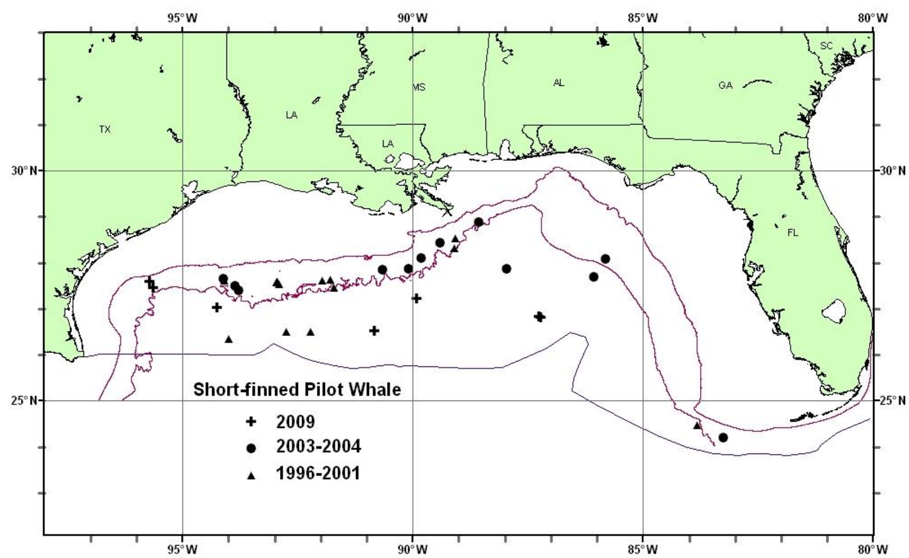

Figure 1. *Distribution of short-finned pilot whale sightings from SEFSC ~~spring~~ vessel surveys during spring 1996-2001~~, and from~~ summer 2003 and spring 2004, and summer 2009~~ surveys~~. All the on-effort sightings are shown, though not all were used to estimate abundance. Solid lines indicate the 100m and 1,000m isobaths and the offshore extent of the U.S. EEZ.*

Earlier abundance estimates

All 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 line-transect survey data collected from ships in the oceanic northern Gulf of Mexico (i.e., 200m isobath to seaward extent ~~of the U.S. EEZ), and are summarized~~ of the U.S. EEZ) and are summarized in Appendix IV.

From 1991 through 1994, and from 1996 through 2001 (excluding 1998), annual surveys were conducted during spring along a fixed plankton-sampling trackline. Due to limited survey effort in any given year, the survey effort-weighted estimated average abundance of short-finned pilot whales for all surveys combined was estimated. For 1991 to 1994, the estimate was 353 (CV=0.89) (Hansen *et al.* 1995), and for 1996 to 2001, 2,388 (CV=0.48) (Mullin and Fulling 2004; Table 1).

During summer 2003 and spring 2004, surveys dedicated to estimating cetacean abundance were conducted along a grid of uniformly-spaced transect lines from a random start. The abundance estimate for short-finned pilot whales, pooled from 2003 to 2004, was 716 (CV=0.34) (Mullin 2007; Table 1).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 in conjunction with bluefin tuna ichthyoplankton surveys during spring in the northern Gulf of Mexico from the 200m isobath to the seaward extent of the U.S. EEZ (Hansen *et al.* 1995). Annual cetacean surveys were conducted along a fixed plankton sampling trackline. Survey effort-weighted estimated average abundance of short-finned pilot whales for all surveys combined was 353 (CV=0.89) (Hansen *et al.* 1995; Table 1).

Similar surveys were conducted during spring from 1996 to 2001 (excluding 1998) in oceanic waters of the northern Gulf of Mexico. 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, was 2,388 (CV=0.48) (Mullin and Fulling 2004; Table 1).

Recent surveys and abundance estimates

During summer 2003 and spring 2004, line-transect surveys dedicated to estimating the abundance of oceanic cetaceans were conducted in the northern Gulf of Mexico. During each year, a grid of uniformly-spaced transect lines from a random start were surveyed from the 200m isobath to the seaward extent of the U.S. EEZ using NOAA Ship *Gordon Gunter* (Mullin 2007).

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. Because most of the data for estimates prior to 2003 were older than this 8-year limit and due to the different sampling strategies, estimates from the 2003 and 2004 surveys were considered most reliable. The estimate of abundance for short-finned pilot whales in oceanic waters, pooled from 2003 to 2004, was 716 (CV=0.34) (Mullin 2007; Table 1), which is the best available abundance estimate for this species in the northern Gulf of Mexico. During summer 2009, a line-transect survey dedicated to estimating the abundance of oceanic cetaceans was conducted in the northern Gulf of Mexico using NOAA Ship *Gordon Gunter*. Survey lines were stratified in relation to depth and the location of the Loop Current. The abundance estimate for short-finned pilot whales in oceanic waters during 2009 was 2,415 (CV=0.66; Table 1).

Table 1. Summary of abundance estimates for northern Gulf of Mexico short-finned pilot whales. 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
Apr-Jun 1991-1994	Oceanic waters	353	0.89
Apr-Jun 1996-2001 (excluding 1998)	Oceanic waters	2,388	0.48
Jun-Aug 2003, Apr-Jun 2004	Oceanic waters	716	0.34
Jun-Aug 2009	Oceanic waters	2,415	0.66

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 2,415716 (CV=0.660.34). The minimum population estimate for the northern Gulf of Mexico is 1,456542 short-finned pilot whales.

Current Population Trend

There are insufficient data to determine the population trends for this species. The pooled abundance estimate for 2003-2004 of 716 (CV=0.34) and that for 1996-2001 of 2,388 (CV=0.48) are not significantly different (P>0.05), but due to the imprecision of the estimates, the power to detect a difference is low. The abundance estimate for 1991-1994 was 353 (CV=0.52). These temporal abundance estimates are difficult to interpret without a Gulf of Mexico-wide understanding of short-finned pilot whale abundance. Four point estimates of short-finned pilot whale abundance have been made based on data from surveys covering 1991-2009. The estimates vary by a maximum factor of nearly seven. To determine whether changes in abundance have occurred over this period, an analysis of all the survey data needs to be conducted which incorporates covariates (e.g., survey conditions, season) that could potentially affect estimates. Nevertheless, differences in temporal abundance estimates will still be difficult to interpret without a Gulf of Mexico-wide understanding of short-finned pilot whale abundance. ~~The Gulf of Mexico is composed of waters belonging to the U.S., Mexico and Cuba. U.S. waters only comprise about 40% of the entire Gulf of Mexico, and 65% of oceanic waters are south of the U.S. EEZ.~~ The oceanography of the Gulf of Mexico is quite dynamic, and the spatial scale of the Gulf is small relative to the ability of most cetacean species to travel. Studies based on abundance and distribution surveys restricted to U.S. waters are unable to detect temporal shifts in distribution beyond U.S. waters that might account for any changes in abundance.

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 ~~b~~Biological ~~r~~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 1,456~~542~~. The maximum productivity rate is 0.04, the default value for cetaceans. The ~~"recovery"~~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 15~~5.4~~.

ANNUAL HUMAN-CAUSED MORTALITY AND SERIOUS INJURY

There has been no reported fishing-related mortality or serious injury of a short-finned pilot whale during 1998-~~2007~~2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). However, during 2006 there was 1 short-finned pilot whale released alive with no serious injury after an entanglement interaction with the pelagic longline fishery (Fairfield-Walsh and Garrison 2007).

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.~~ The commercial fishery which potentially could interact with this stock in the Gulf of Mexico is the Atlantic Ocean, Caribbean, Gulf of Mexico large pelagic longline fishery (Appendix III). Pelagic swordfish, tunas and billfish are the targets of the longline fishery operating in the northern Gulf of Mexico. There were no ~~recent~~ reports of mortality or serious injury to short-finned pilot whales by this fishery during 1998-2010 (Yeung 1999; Yeung 2001; Garrison 2003; Garrison and Richards 2004; Garrison 2005; Fairfield Walsh and Garrison 2006; Fairfield-Walsh and Garrison 2007; Fairfield and Garrison 2008; Garrison *et al.* 2009; Garrison and Stokes 2010; 2011). During 2006, 1 short-finned pilot whale was observed entangled and released alive with no serious injury. The animal was not hooked, but was lassoed around its body in front of the flippers (not through the mouth). It was disentangled and was observed swimming away quickly (Fairfield-Walsh and Garrison 2007). 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 have been 2 reported ~~mass~~ stranding~~s~~ events of short-finned pilot whales in the Gulf of Mexico ~~since~~during 2006-2010 (NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 November 2011) ~~1999~~. ~~Both mass strandings occurred in Florida. Two animals mass stranded in May 1999, and 9 animals in October 2001. No evidence of human interactions was detected for these stranded animals. There were no other documented strandings of short-finned pilot whales in the Gulf of Mexico during 1999-2005 or during 2007.~~ One short-finned pilot whale stranded during 2006 in Florida; no evidence of human interactions was detected for this animal. Four short-finned pilot whales mass stranded during 2008 in Florida; it could not be determined if there was evidence of human interactions ~~(NOAA National Marine Mammal Health and Stranding Response Database unpublished data, accessed 16 September 2008)~~. 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.

An Unusual Mortality Event (UME) was declared for cetaceans in the northern Gulf of Mexico beginning 1 February 2010, and as of February 2010; and, as of early 2012, the event is still ongoing. It includes cetaceans that stranded prior to the Deepwater Horizon oil spill (see "Habitat Issues" below), during the spill, and after. During 2010, no animals from this stock were considered to be part of the UME.

HABITAT ISSUES

The Deepwater Horizon (DWH) MC252 drilling platform, located approximately 50 miles southeast of the Mississippi River Delta in waters about 1500m deep, exploded on 20 April 2010. The rig sank, and for 87 days millions of barrels of oil and gas were discharged from the wellhead until it was capped on 15 July 2010. During the response effort dispersants were applied extensively at the seafloor and at the sea surface (Lehr *et al.* 2010; OSAT 2010). In-situ burning, or controlled burning of oil at the surface, was also used extensively as a response tool (Lehr *et al.* 2010). The oil, dispersant and burn residue compounds present ecological concerns. The magnitude of this oil spill was unprecedented in U.S. history, causing impacts to wildlife, natural habitats and human communities along coastal areas from western Louisiana to the Florida Panhandle (NOAA 2011). It could be years before the entire scope of damage is ascertained (NOAA 2011).

Shortly after the oil spill, the Natural Resource Damage Assessment (NRDA) process was initiated under the Oil Pollution Act of 1990. A variety of NRDA research studies are being conducted to determine potential impacts of the spill on marine mammals. These studies have focused on identifying the type, magnitude, severity, length and impact of oil exposure to oceanic, coastal and estuarine marine mammals. The research is ongoing and likely will continue for some time. For oceanic dolphins the NOAA-led effortsFor continental shelf and oceanic cetaceans, the NOAA-led efforts include: aerial surveys to document the distribution, abundance, species and exposure of marine mammals and turtles relative to oil from DWH spill; and ship surveys to evaluate exposure to oil and other chemicals and to assess changes in animal behavior and distribution relative to oil exposure through visual and acoustic surveys, deployment of passive acoustic monitoring systems, collection of tissue samples, and deployment of satellite tags on sperm and Bryde's whales.

Aerial surveys have observed Risso's dolphins, spinner dolphins, pantropical spotted dolphins, striped dolphins, bottlenose dolphins and sperm whales swimming in oil in offshore waters (NOAA 2010a). The effects of oil exposure on marine mammals depend on a number of factors including the type and mixture of chemicals involved, the amount, frequency and duration of exposure, the route of exposure (inhaled, ingested, absorbed, or external) and biomedical risk factors of the particular animal (Geraci 1990; NOAA 2010b). In general, direct external contact with petroleum compounds or dispersants with skin may cause skin irritation, chemical burns and infections. Inhalation of volatile petroleum compounds or dispersants may irritate or injure the respiratory tract, which could lead to pneumonia or inflammation. Ingestion of petroleum compounds may cause injury to the gastrointestinal tract, which could affect an animal's ability to digest or absorb food. Absorption of petroleum compounds or dispersants may damage kidney, liver and brain function in addition to causing immune suppression and anemia. Long term chronic effects such as lowered reproductive success and decreased survival may occur (Geraci 1990; NOAA 2010b).

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. Total human-caused mortality and serious injury for this stock is not known. There is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. This is not a strategic stock because it is assumed that the average annual human-related mortality and serious injury does not exceed PBR.

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