AFFECTED ENVIRONMENT CHAPTER 4

Consistent with Section 1502.15 of the CEQ NEPA regulations (40 CFR Part 1500), this chapter describes key components of the environment affected by the ALWTRP regulatory alternatives. Four major components are examined in detail:

- Section 4.2 discusses the status of Atlantic large whale species;
- Section 4.2 considers the economic and social aspects of the fisheries affected by the ALWTRP rules;
- Section 4.3 describes other protected species that may be affected by elements of the ALWTRP; and
- Section 4.4 provides information about habitat for affected commercial fish species.

4.1 STATUS OF ATLANTIC LARGE WHALE SPECIES

The discussion below examines the status of four key large whale species: the North Atlantic right whale, the humpback whale, the fin whale, and the minke whale. The discussion describes the range, life history, and abundance of each species, as well as factors that may affect their survival (including entanglement).

4.1.1 North Atlantic Right Whale

The North Atlantic right whale (*Eubalaena glacialis*) is among the most endangered large whale species in the world. Two populations, an eastern and a western, are typically recognized (IWC, 1986). However, animals are sighted so infrequently in the eastern Atlantic, it is unclear whether a viable population still exists (NMFS, 1991a). This analysis focuses on the western North Atlantic population of right whales, which occurs in the proposed action area.

North Atlantic right whales are one of the most intensely studied cetacean species. Yet, despite decades of conservation measures, the population remains at low numbers. Fewer than

200 females are estimated in the population (Best et al., 2001). As of 1998, there were only an estimated 75 females known to have given birth (Kraus et al., 2001). Modeling work using data collected through the mid-1990s indicated that if the conditions that existed at that time were to continue, western North Atlantic right whales would be extinct within 200 years (Caswell et al., 1999). Subsequent work using a number of different models as well as additional data collected throughout the 1990s all indicated that the population of the western North Atlantic right whale population has continued to decline (Clapham et al., 2002).

NMFS believes that the western population of North Atlantic right whales is well below the optimum sustainable population (OSP), especially given apparent declines in the population. As such, potential biological removal (PBR) has been set to zero, (i.e., any mortality or serious injury to the species is considered significant).

The North Atlantic right whale is also listed as endangered under the ESA. Pursuant to the ESA, a Recovery Plan was published in 1991, and a revised plan is under review.

In 1994, NMFS published a final rule designating critical habitat for right whales (59 FR 28793, June 3, 1994). The designated critical habitat included portions of Cape Cod Bay and Stellwagen Bank, the Great South Channel (each off the coast of Massachusetts), and the waters adjacent to the coast of Georgia and the east coast of Florida. These areas were determined to be essential to the conservation of right whales because of their importance as foraging, calving, and nursing habitats. For example, Cape Cod Bay and the Great South Channel represent two of the four known principal feeding grounds for adult right whales in the Western North Atlantic and the only two within U.S. waters. In addition, the waters off Georgia and Northern Florida have been identified as the only known calving ground for right whales. However, the designations were based primarily on right whale sightings data as opposed to an analysis of the physical and biological habitat features essential to the conservation of the species.

In July 2002, NMFS received a petition requesting revision of the current critical habitat designation for right whales, by combining and expanding the current Cape Cod Bay and Great South Channel critical habitats in the Northeast and by expanding the current critical habitat in the Southeast. In August 2003, NMFS determined that the requested revision, as specified by the petitioner, was not warranted at that time. However, NMFS indicated that it would continue to analyze the physical and biological habitat features essential to the conservation of right whales. Specifically, in the waters off the Northeast U.S., NMFS plans to continue its own work and collaborate with others working in the Gulf of Maine ecosystem to characterize the spatial and temporal distribution of zooplankton. Furthermore, in the waters off the Southeast U.S., NMFS will continue to analyze right whale distribution data in relation to bathymetry and sea surface temperature derived from Advanced Very High Resolution Radiometer (AVHRR) imagery (68 FR 51758).

4.1.1.1 Range

North Atlantic right whales have a wide distribution that overlaps with U.S. and Canadian commercial fishing grounds in the western Atlantic as well as shipping traffic to and

from numerous ports. Coastal areas frequented by right whales are heavily developed. North Atlantic right whales generally occur west of the Gulf Stream; from the southeast U.S. to Canada (e.g., Bay of Fundy and Scotian Shelf) (Kenney, 2002; Waring et al., 2003). They are not found in the Caribbean and have been recorded only rarely in the Gulf of Mexico. North Atlantic right whales are abundant in Cape Cod Bay between February and April (Hamilton and Mayo, 1990; Schevill et al., 1986; Watkins and Schevill, 1982) and in the Great South Channel in May and June (Kenney et al., 1986; Payne et al., 1990). North Atlantic right whales also frequent Stellwagen Bank and Jeffrey's Ledge, as well as Canadian waters including the Bay of Fundy and Browns and Baccaro Banks, in the spring through fall. The distribution of right whales in summer and fall seems linked to the distribution of their principal zooplankton prey (Winn et al., 1986). Calving occurs in the winter months in coastal waters off of Georgia and Florida (Kraus et al., 1988). Mid-Atlantic waters are used as a migratory pathway from the spring and summer feeding/nursery areas to the winter calving grounds off the coast of Georgia and Florida.

It is generally said that North Atlantic right whales, like other baleen whales, winter in the lower latitudes where calving takes place, then tend to migrate to higher latitudes for the summer. However, there is much about right whale movements and habitat that is still not fully understood. Telemetry data have shown lengthy and somewhat distant excursions into deep water off the continental shelf (Mate et al., 1997). Photo-ID data have also indicated excursions of animals as far as Newfoundland, the Labrador Basin, southeast of Greenland, and Norway (Knowlton et al., 1992). In the winter, only a minority of the known right whale population appears on the calving grounds. The winter distribution of the remaining right whales remains uncertain (Waring et al., 2003). Results from winter surveys and passive acoustic studies suggest that animals may be dispersed in several areas including Cape Cod Bay (Brown et al., 2002) and offshore areas of the southeastern U.S. (Waring et al., 2003). During the winter of 1999/2000, significant numbers of right whales were recorded in the Charleston, SC area. Because survey efforts in the Mid-Atlantic have been limited, it is unknown whether this is typical or whether it represents a northern expansion of the normal winter range, perhaps due to unseasonably warm waters.

Other uncertainties also exist. For example, some female right whales have never been observed on the Georgia/Florida calving grounds but have been observed with a calf on the foraging grounds the following spring/summer (Best, et al., 2001). It is unknown whether these females are calving in an unidentified calving area or have been missed during surveys off of Florida and Georgia (Best, et al., 2001). To a greater degree, some mature females that are observed in the Southeast U.S. calving grounds are not re-sighted in the Bay of Fundy. In fact, analysis based on both genetics and sighting histories of photographically identified individuals suggest that approximately one-third of the known population utilizes summer nursery areas other than the Bay of Fundy (Waring et al., 2003). This, along with the absence of some photo-identified whales from known habitats for months or years at a time suggests the presence of an unknown, offshore feeding ground (Kenney, 2002). Finally, the location of the North Atlantic right whale's mating area(s) is largely unknown. While behavior suggestive of mating is frequently observed on the foraging grounds, given the known length of gestation in other baleen whales, it is more likely that mating and conception occur in the winter (Kenney, 2002). However, as mentioned above, many of the mature whales in this population are not sighted on the known calving grounds off the southeastern U.S. during these months. This information,

along with genetics data, suggest that two mating areas may exist with a somewhat different population composition (Best et al., 2001).

4.1.1.2 Life History and Reproductive Success

Kraus et al. have estimated the mean age at first calving for female right whales to be 9.53 (+/- 2.32) years (Reeves et al., 2001).[1] Calving interval rates, which averaged 3.7 years between 1980 and 1992, have increased significantly and now average more than five years across all ages (Kraus et al., 2001). This lengthening of the mean calving interval was first noticed in the early 1990s but was only confirmed to be significant in the mid-1990s. Additionally, the total number of calves observed since 1990 (believed to reflect the true total in the population) has been about half of what would have been expected from comparison with Southern Hemisphere females (Reeves et al., 2001). The North Atlantic right whale is the only baleen whale for which declining reproductive success has been documented. Other whale populations at equally low numbers have not exhibited similar reproductive patterns, including the eastern North Pacific right whale population.

Between 1980 and 2000, a total of 222 right whale births were documented in the western North Atlantic. Of these, seven are known to have died. Due to low calf production in 1999 (four calves) and 2000 (one calf), in April 2000, the Northeast Fisheries Science Center brought together 35 scientists from a broad range of disciplines to identify factors potentially affecting reproduction dysfunction in North Atlantic right whales. At this workshop, five factors were considered as potential contributors to the declining reproductive success of North Atlantic right whales: (1) environmental contaminants/endocrine disrupters; (2) body condition/nutritional stress; (3) genetics; (4) infectious diseases; and (5) marine biotoxins. The workshop concluded that none of the five factors could be eliminated as possible contributors to the observed reproductive dysfunction. Furthermore, the workshop concluded that if calf production and recruitment do not recover from the low levels observed in recent years, the population of North Atlantic right whales is unlikely to recover, even if known anthropogenic causes of mortality are reduced to zero (Reeves et al., 2001).

Since 1999, there have been at least 88 right whale births through the 2003/2004 calving season: one in 1999/2000, a record 31 in 2000/2001, 21 in 2001/2002, 19 in 2002/2003, and at least 16 in 2003/2004 (which includes a calf that washed ashore alive but later died) (Pike, 2003). In addition, one animal was “resurrected,” meaning that it was seen after an absence of at least six years. However, the population has continued to experience losses of calves, juveniles, and adults during the same time period. These losses include reproductive females. One of the females was carrying her sixth known calf at the time of her death and was one of the largest western North Atlantic right whales on record (unpublished necropsy report submitted to NMFS).

[1] The longevity of right whales is unknown.

4.1.1.3 Abundance

As is the case with most wild animals, an exact count of right whales in the Western North Atlantic cannot be obtained. However, abundance can be reasonably estimated as a result of extensive study of this population. A photographic database is maintained that, as of 2002, included 26,654 sightings of 435 individual North Atlantic right whales from 1935-2002 (Pettis et al., 2004). IWC participants from a 1999 workshop agreed that it is reasonable to state that the current number of western North Atlantic right whales is probably around 300 (+/- 10 percent) (Best, et al., 2001). This conclusion was based, in large part, on a photo-ID catalog comprising more than 14,000 photographed sightings of 396 individuals, 11 of which were known to be dead and 87 of which had not been seen in more than six years. In addition, it was noted that relatively few new non-calf whales (whales that were never sighted and counted in the population as calves) had been sighted in recent years, suggesting that the 396 individuals was a close approximation of the entire population.

As is the case with other mammalian species, there is an interest in monitoring the number of females in the western North Atlantic right whale population since their numbers will affect the overall population trend. Participants at the 1999 IWC workshop reviewed the sex composition of this right whale population based on sighting and genetics data (Best, et al., 2001). Of the 385 right whales presumed alive at the end of 1998, 157 were males, 153 were females, and 75 were of unknown sex (Best et al., 2001). Sightings data were also used to determine the number of presumably mature females (females known to be at least nine years old) in the population and the number of females observed with at least one calf. For the period 1980 to 1998, there were at least 90 (presumed living) females nine years old or greater. Of these, 75 had produced a calf during that same period (Best, et al., 2001; Kraus et al., 2001). As described above, the 2000/2001 and 2002/2003 calving seasons have had relatively high calf production and included additional first time mothers. These potential gains have been offset, however, by continued losses to the population, including the deaths of mature females.

The 1999 IWC workshop participants also reviewed photo-ID data and modeling of right whale survival (Best, et al., 2001). Despite differences in approach, all of the models indicated a decline in right whale survival in the 1990s relative to the 1980s with female survival, in particular, apparently affected (Best et al., 2001; Waring et al., 2003). In 2002, the NMFS Northeast Fisheries Science Center (NEFSC) hosted a workshop to review right whale population models and examine potential bias in the models and changes in the population trend based on new information collected in the late 1990s (Clapham et al., 2002). Three different models were used to explore right whale survivability and to address potential sources of bias. Although biases were identified that could negatively affect the results, all three modeling techniques resulted in the same conclusion: survival has continued to decline and the decline appears to be focused on females (Clapham et al., 2002).

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). NMFS believes that this population of North Atlantic right whales is well below the optimum sustainable population (OSP), especially given apparent declines in the population. As such, potential biological removal (PBR) has been set to zero, i.e., any mortality or serious injury to the species is considered significant.

4.1.1.4 Factors Affecting Survival

In addition to modeling work which suggests that right whale abundance is declining as a result of reduced survival, some researchers have also suggested that the population is affected by a decreased reproductive rate (Best et al., 2001; Kraus et al., 2001). Kraus et al. (2001) reviewed reproductive parameters from 1980 to 1998 and found that calving intervals had increased from 3.67 years in 1992 to 5.8 years in 1998. In addition, as of 1999, only 70 percent of mature females (aged nine years or older) were known to have given birth (Best, et al., 2001). Several factors -- reduced genetic diversity, pollution, and nutritional stress -- have been considered to help explain an apparent decline in reproductive success (Best, et al., 2001; Kraus et al., 2001):

- **Reduced Genetic Diversity**: Historically, the North Atlantic right whale was driven to near-extinction by 800 years of commercial hunting. The size of the western North Atlantic population of right whales at the termination of whaling is unknown, but is generally believed to have been very small. Such an event may have resulted in a loss of genetic diversity which could affect the ability of the current population to successfully reproduce (i.e., decreased conceptions, increased abortions, and increased neonate mortality). Studies by Schaeff et al. (1997) and Malik et al. (2000) indicate that western North Atlantic right whales are less genetically diverse than southern right whales (Schaeff et al., 1997; Malik et al., 2000). However, several apparently healthy populations of cetaceans, such as sperm whales and pilot whales, have even lower genetic diversity than observed for western North Atlantic right whales (Best, et al., 2001).

- **Pollution**: While contaminant studies have confirmed that right whales are exposed to and accumulate contaminants, researchers could not conclude that these contaminant loads were negatively affecting right whales since concentrations were lower than those found in marine mammals proven to be affected by PCBs and DDT (Weisbrod et al., 2000).

- **Nutritional Stress**: Although North Atlantic right whales have thinner blubber than right whales from the South Atlantic, there is no evidence at present to demonstrate that the decline in birth rate and increase in calving interval is related to a food shortage (Kenney, 2000). Experts at the 1999 IWC workshop pointed out that since *Calanus* sp. is the most common zooplankton in the North Atlantic and current right whale abundance is greatly below historical levels, food limitations do not seem to be a significant factor (Best et al., 2001). Nevertheless, a connection between right whale reproduction and environmental factors may yet be found. Modeling work by Caswell and Fujiwara suggests that the North Atlantic Oscillation (NAO), a naturally occurring climactic event, does affect the survival of mothers, the reproductive rate of mature females, and calf survival (Clapham et al., 2002). Further work is needed to assess the

magnitude and manner in which the NAO may affect right whale reproductive success.

The small population size and low annual reproductive rate suggest that human sources of mortality may have a greater effect relative to population growth rates that for other whales (Waring et al., 2003). Ship strikes and fishing gear entanglements are the principal factors believed to be retarding growth and recovery of western North Atlantic right whales. Data collected from 1970 through 1999 indicate that anthropogenic interactions in the form of ship strikes and gear entanglements are responsible for a minimum of two-thirds of the confirmed and possible mortality of non-neonate right whales. Of the 45 right whale mortalities documented during this period, 16 were due to ship collisions and three were due to entanglement in fishing gear (there were also 13 neonate deaths and 13 deaths of non-calf animals from unknown causes). Based on the criteria developed by Knowlton and Kraus (2001), 56 additional serious injuries and mortalities from entanglement or ship strikes are believed to have occurred between 1970 and 1999: 25 from ship strikes and 31 from entanglement. Nineteen were considered to be fatal interactions (16 ship strikes, three entanglements); ten were possibly fatal (two ship strikes, eight entanglements); and 27 were non-fatal (seven ship strikes, 20 entanglements) (Knowlton and Kraus, 2001). As mentioned above, the population has continued to suffer losses that are attributed to ship strikes and fishing gear entanglements (Hartley et al., 2003; Waring et al., 2003; Whittingham et al., 2003; Whittingham et al., in draft).

Scarification analysis also provides information on the number of right whales that have survived ship strikes and fishing gear entanglements. Based on photographs of catalogued animals from 1959 and 1989, Kraus (1990) estimated that 57 percent of right whales exhibited scars from entanglement and seven percent from ship strikes (propeller injuries) (Kraus, 1990). This work was updated by Hamilton et al. (1998) using data from 1935 through 1995. The new study estimated that 61.6 percent of right whales exhibit injuries caused by entanglement, and 6.4 percent exhibit signs of injury from vessel strikes. In addition, several whales have apparently been entangled on more than one occasion and some right whales that have been entangled were subsequently involved in ship strikes. Knowlton et al. (2003) found that 543 separate entanglement interactions documented between 1980 and 2000 involved 413 individual right whales. The number of entanglements per individual ranged from zero to five. Of the 413 right whales, 71.9 percent (297 right whales) showed signs of having been entangled. Nearly 35 percent (144 of 413) were entangled at least once and 0.9 percent (four animals) were entangled at least five times. Because some animals may drown or be killed immediately, the actual number of interactions is expected to be higher. 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 (Waring et al., 2003).

4.1.1.5 Behavior and Susceptibility to Entanglement

As mentioned previously, right whales are susceptible to entanglement in fishing gear. Johnson et al. (2005) noted that any part of the gear (buoy line, groundline, floatline, and surface system line) creates a risk for entanglement. Several aspects of right whale behavior may contribute to this high entanglement frequency.

Of 31 recorded right whale entanglement events examined between 1993 and 2002, 24 of them (77.4 percent) involved animals with gear in the mouth (some included other points of gear attachment on the body as well) and 16 (51.6 percent) were entangled only at the mouth (Johnson et al., 2005). In contrast, seven entanglement events involved right whales with entangling gear on the tail (some included other points of gear attachment on the body as well). This suggests that a large number of entanglements occur while right whales feed, since open mouth behavior is generally associated with feeding only. Although the sample size was small for cases in which the point of gear attachment and the associated gear part could be examined, Johnson et al. (2005) reported that two out of three right whale floating groundline entanglements and six out of eight vertical line entanglements (buoy line and surface system lines) involved the mouth (note that some of these cases may have involved other body parts as well).[2] In addition, two buoy line entanglement events involved the tail; the entanglement of one of these animals additionally involved groundline.

Right whales feed by swimming continuously with their mouths open, filtering large amounts of water through their baleen and capturing zooplankton on the baleen's inner surface. A study of right whale foraging behavior in Cape Cod Bay conducted by Mayo and Marx (1990) revealed that right whales feeding at the surface had their mouths open for approximately 58 minutes of each hour. Also, feeding right whales exhibited increased turning behavior and a convoluted path once they had found a sufficiently dense patch of zooplankton on which to feed. This behavior differed significantly from that of traveling whales, who swam in relatively straight paths with their mouths closed. In addition, socializing whales (two or more whales at the surface occasionally making physical contact) exhibited even more twisted paths than feeding whales. Socializing was often associated with rolling and lifting the flippers above the water's surface, behaviors that may add to entanglement risk, especially from buoy line and surface system lines.

Goodyear (1996) studied well-known right whale feeding areas (Cape Cod/Massachusetts Bay, Great South Channel, and the Bay of Fundy) and reported that feeding behavior varies based on the location of prey. Right whales spend a substantial amount of time feeding below the surface in the Bay of Fundy, where no surface feeding activities were observed. In order to meet their metabolic needs, right whales must feed on dense aggregations of copepods. Right whales received most of their food energy (approximately 91.1 percent) during deep dives (average depth of 134 meters), with the remainder (approximately 9.9 percent) occurring through surface feeding. Right whales spend about one-third of their time surface feeding in the Cape Cod/Massachusetts Bay and Gulf of Maine areas, which may increase entanglement risk from buoy line and surface system lines during the times they visit these areas (December to May). While in the Great South Channel (April to June), right whales spend approximately 10 percent of the time feeding at the surface and 90 percent of the time feeding at lower depths.

[2] Not included in these numbers is one right whale that was entangled in both buoy line and groundline on the tail.

4.1.2 Humpback Whale

The North Atlantic humpback whale (*Megaptera novaeangliae*) is listed as an endangered species under the ESA. A Recovery Plan has been published and is in effect (NMFS, 1991b).

4.1.2.1 Range

In the North Atlantic, humpback whales calve and mate in the West Indies during the winter and migrate to feeding areas in the northwestern Atlantic during the summer months. Most of the humpbacks that forage in the Gulf of Maine visit Stellwagen Bank and the waters of Massachusetts and Cape Cod Bays. Sightings are most frequent from mid-March through November between 41 degrees north and 43 degrees north, from the Great South Channel north along the outside of Cape Cod to Stellwagen Bank and Jeffrey's Ledge, and peak in May and August (CETAP, 1982). Small numbers of individuals may be present in this area year-round, including the waters of Stellwagen Bank. They feed on a number of species of small schooling fishes, particularly sand lance and Atlantic herring, by targeting fish schools and filtering large amounts of water for their associated prey. Humpback whales have also been observed feeding on krill (Wynne and Schwartz, 1999).

In winter, humpback whales from different feeding areas mate and calve primarily in the West Indies, where spatial and genetic mixing among these groups occurs (Clapham et al., 1993; Katona and Beard, 1990; Palsboll et al., 1997; Stevick et al., 1998). Various papers have summarized information gathered from a catalogue of photographs of 643 individuals from the western North Atlantic population of humpback whales (Clapham, 1992; Clapham and Mayo, 1990; Clapham et al., 1999; Barlow and Clapham, 1997). These photographs identified reproductively mature western North Atlantic humpbacks wintering in tropical breeding grounds in the Antilles, primarily on Silver and Navidad Banks, north of the Dominican Republic. The primary winter range also includes the Virgin Islands and Puerto Rico.

Humpback whales use the Mid-Atlantic as a migratory pathway to and from the calving/mating grounds, but it may also be an important winter feeding area for juveniles. Since 1989, observations of juvenile humpbacks in the Mid-Atlantic have been increasing during the winter months, peaking from January through March (Swingle et al., 1993). Biologists theorize that non-reproductive animals may be establishing a winter feeding range in the Mid-Atlantic since they are not participating in reproductive behavior in the Caribbean. Swingle et al. (1993) identified a shift in distribution of juvenile humpback whales in the nearshore waters of Virginia, primarily in winter months. Identified whales using the Mid-Atlantic area were found to be residents of the Gulf of Maine and Atlantic Canada (Gulf of St. Lawrence and Newfoundland) feeding groups, suggesting a mixing of different feeding populations in the Mid-Atlantic region. Strandings of humpback whales have increased between New Jersey and Florida since 1985 consistent with the increase in Mid-Atlantic whale sightings. Strandings were most frequent from September through April in North Carolina and Virginia waters, and involved primarily juvenile humpback whales of no more than 11 meters in length (Wiley et al., 1995).

4.1.2.2 Life History and Reproductive Success

Females reach sexual maturity at approximately four to six years of age and males at seven to 15 years of age. Size at sexual maturity is about 12 meters. It is generally believed that copulation and calving takes place on the winter range in the Antilles, Virgin Islands, and Puerto Rico. The gestation period in humpback whales is 12 months and females give birth every two to three years, usually between December and May (NMFS, 2001b).

4.1.2.3 Abundance

Photographic mark-recapture analyses from the Years of the North Atlantic Humpback (YONAH) project gave an ocean-basin-wide population estimate of 11,570 for 1992/1993 (CV = 0.069, Stevick et al., 2001). This estimate is regarded as the best available estimate for the North Atlantic population, though the figure is considered negatively biased because YONAH sampling was not spatially representative in the feeding grounds (Waring et al., 2003). Researchers have used three approaches in their attempt to estimate the abundance for the Gulf of Maine stock: mark-recapture estimates, minimum population size, and line-transect estimates. The estimate of 902 (CV = 0.41) individuals yielded from the line-transect survey method is currently regarded as the best estimate of abundance (Waring et al., 2003).

Modeling using data obtained from photographic mark-recapture studies estimates the growth rate of the Gulf of Maine feeding population at 6.5 percent (Barlow and Clapham, 1997). With respect to the North Atlantic population overall, there are also indications of increasing abundance; one study estimated a growth rate of 3.2 percent for the period from 1979 to 1993 (Stevick et al., 2001). However, trend and abundance data are lacking for the western North Pacific stock, the Southern Hemisphere humpback whales, and the Southern Indian Ocean humpbacks. Given the best available information, changes in status of the North Atlantic humpback population are, therefore, likely to affect the overall survival and recovery of the species.

As noted, 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 647. The maximum productivity rate is 0.04, the default value for cetaceans. The “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 humpback whale is listed as endangered under the Endangered Species Act (ESA). Thus, PBR for the Gulf of Maine humpback whale stock is 1.3 whales per year.

4.1.2.4 Factors Affecting Survival

Humpback whales, like other baleen whales, may be adversely affected by habitat degradation, habitat exclusion, acoustic trauma, harassment, or reduction in prey resources attributable to commercial fishing, coastal development, vessel traffic, and other influences.

However, explicit evidence of these influences is limited. Changes in humpback distribution in the Gulf of Maine have been found to be associated with changes in herring, mackerel, and sand lance abundance associated with local fishing pressures (Payne et al., 1986). Likewise, there are strong indications that a mass mortality of humpback whales in the southern Gulf of Maine in 1987/1988 was the result of the consumption of mackerel whose livers contained high levels of a red-tide toxin. It has been suggested that red tides are related to increased freshwater runoff from coastal development, but there are insufficient data to link these effects directly with humpback whale mortality (Clapham et al., 1999).

As is the case with other large whales, the major known sources of anthropogenic mortality and injury of humpback whales are commercial fishing gear entanglements and ship strikes. Sixty percent of Mid-Atlantic humpback whale mortalities that were closely investigated showed signs of entanglement or vessel collision (Wiley et al., 1995). Between 1992 and 2001, at least 92 humpback whale entanglements and 10 ship strikes were recorded. Many carcasses also washed ashore or were spotted floating at sea for which the cause of death could not be determined. Based on photographs of the caudal peduncle of humpback whales, Robbins and Mattila (1999) estimated that at least 48 percent -- and possibly as many as 78 percent -- of Gulf of Maine stock humpback whales exhibit scarring caused by entanglement. These estimates are based on sightings of free-swimming animals that initially survive the encounter. Because some whales may drown immediately, the actual number of interactions may be higher. 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 (Waring et al., 2003).

4.1.2.5 Behavior and Susceptibility to Entanglement

As mentioned previously, humpback whales are, like right whales, susceptible to entanglement in fishing gear. Johnson et al. (2005) noted that any part of the gear (buoy line, groundline, floatline, and surface system line) creates a risk for entanglement. Johnson et al. (2005) also reported that of the 30 reported humpback whale entanglements examined in the study, 16 (53 percent) involved entanglements in the tail region and 13 (43 percent) involved entanglements in the mouth (note that for both the mouth and tail, some included other points of gear attachment on the body). Although the sample size was small for cases in which the point of gear attachment and the associated gear part could be examined, two out of two floating groundline entanglements and four out of seven buoy line entanglements involved the mouth.[3] In addition, five out of seven buoy line entanglements and three out of four gillnet floatline entanglements involved the tail (Johnson et al., 2005).[4]

Based on studies of humpback whale caudal peduncle scars, Robbins and Mattila (2000) reported that calves had a lower entanglement risk than yearlings, juveniles, and mature whales; the latter three maturational classes exhibited comparable levels of high probability scarring.

[3] Note that one humpback whale was entangled in both buoy line and groundline and was placed in both categories.

[4] Note that the entanglements in buoy line exceed the total of seven because some animals were entangled in multiple locations on their body (e.g., both the mouth and the tail).

Based on these data as well as evidence that animals acquire new injuries when mature, the authors concluded that actively feeding whales may be at more of a risk for entanglement. In any case, juveniles seemed to be at the most risk, possibly due to their relative inexperience.

Humpback whales employ a variety of foraging techniques, which differ from right whale foraging behavior, but which may create entanglement risk. Volgenau and Kraus (1990) describe a variety of humpback whale feeding techniques. One involves lunge feeding, in which the whale swims toward a patch of krill or small fish, then lunges into the patch with its mouth agape. The flippers may aid in concentrating the prey or in maneuvering. Another feeding method, called "flick-feeding," involves flexing the tail forward when the whale is just below the surface, which propels water over the whale's head, temporarily disorienting its prey. The whale then swims with its mouth open, through the wave it created. A third foraging strategy is bubble feeding, in which whales swim upwards, while blowing nets or clouds of bubbles, in a spiral under a concentration of prey. This creates a barrier through which the disoriented fish cannot escape. The whales then swim up through the bubble formation, engulfing their prey. These techniques demonstrate that humpback whales commonly use their mouths, flippers, and tails to aid in feeding. Thus, while foraging, all body parts are at risk of entanglement.

4.1.3 Fin Whale

In 1976, the IWC's Scientific Committee proposed seven stocks for North Atlantic fin whales: (1) North Norway, (2) West Norway-Faroe Islands, (3) British Isles-Spain and Portugal, (4) East Greenland-Iceland, (5) West Greenland, (6) Newfoundland-Labrador, and (7) Nova Scotia (Perry et al., 1999). However, it is uncertain whether these boundaries define biologically isolated units (Waring et al., 2003).

The present IWC scheme defines the North Atlantic fin whale stock off the eastern coast of the U.S., north to Nova Scotia, and east to the southeastern coast of Newfoundland as one single stock (Donovan, 1991). However, information suggests some degree of separation within this population. A number of researchers have suggested the existence of fin whale subpopulations in the North Atlantic based on local depletions resulting from commercial whaling or genetics data (Mizroch and York, 1984; Bérubé et al., 1998). Photoidentification studies in western North Atlantic feeding areas, particularly in Massachusetts Bay, have shown a high rate of annual return by fin whales, both within years and between years, suggesting some level of site fidelity (Seipt et al., 1990).

This particular stock is considered strategic because the fin whale is listed as endangered under the ESA. A Recovery Plan for fin whales is currently awaiting legal process (Waring et al., 2003).

4.1.3.1 Range

Fin whales inhabit a wide range of latitudes between 20 to 75 degrees north and 20 to 75 degrees south (Perry et al., 1999). Like right and humpback whales, fin whales are believed to use high latitude waters primarily for feeding, and low latitude waters for calving. However, evidence regarding where the majority of fin whales winter, calve, and mate is still scarce. Clark (1995) reported a general pattern of fin whale movements in the fall from the Labrador/Newfoundland region, south past Bermuda and into the West Indies, but neonate strandings along the U.S. Mid-Atlantic coast from October through January suggest the possibility of an offshore calving area (Clark, 1995; Hain et al., 1992).

The predominant prey of fin whales varies greatly in different areas depending on what is locally available (IWC, 1992). In the western North Atlantic, fin whales feed on a variety of small schooling fish (e.g., herring, capelin, and sand lance) as well as squid and planktonic crustaceans (Wynne and Schwartz, 1999).

4.1.3.2 Life History and Reproductive Success

Compared to humpback and right whales, relatively little is known about the life history of fin whales. Both males and females reach sexual maturity between five and fifteen years of age (Perry et al., 1999). Conception is believed to occur during a five month period in the winter and, following a 12 month gestation period, females give birth to a single calf.

The mean calving interval is 2.7 years, with a range of between two and three years. Agler et al. (1993) found the gross annual reproductive rate (i.e., calves as a percentage of total population) of fin whales in the Gulf of Maine to be about eight percent during the 1980s. Sigurjonsson (1995) reported the range of pregnancy rates (i.e., percent of adult females pregnant in a given year) for the species as 36 percent to 47 percent.

4.1.3.3 Abundance

Various estimates have been provided to describe the current status of fin whales in western North Atlantic waters. One method used the catch history and trends in catch per unit effort to obtain an estimate of 3,590 to 6,300 fin whales for the entire western North Atlantic (Perry et al., 1999). Hain, et al. estimated that about 5,000 fin whales inhabit the Northeastern U.S. continental shelf waters (Hain et al., 1992). The NMFS 2002 Stock Assessment Report (SAR) gives a best estimate of abundance for fin whales of 2,814; however, this estimate must be considered conservative based on the known range of fin whales in the entire western North Atlantic, as well as the uncertainties regarding population structure and exchange between surveyed and unsurveyed areas (Waring et al., 2003). In addition, the minimum population estimate for the western North Atlantic fin whale is 2,362.

Information on the abundance and population structure of fin whales worldwide is limited. NMFS recognizes three fin whale stocks in the Pacific for the purposes of managing

this species under the MMPA: Alaska (Northeast Pacific), California/Washington/Oregon, and Hawaii. Reliable estimates of current abundance for the entire Northeast Pacific fin whale stock are not available. Stock structure for fin whales in the southern hemisphere is unknown and there are no current estimates of abundance for southern hemisphere fin whales. Therefore, given the best available information, changes in the status of the North Atlantic fin whale population are likely to affect the overall survival and recovery of the species.

As noted, 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). The minimum population size is 2,362. The maximum productivity rate is 0.04, the default value for cetaceans. The "recovery" factor is assumed to be 0.10 because the fin whale is listed as endangered under the ESA. Thus, PBR for the western North Atlantic fin whale is 4.7.

4.1.3.4 Factors Affecting Survival

Hunting of fin whales continued well into the 20th century. Fin whales were given total protection in the North Atlantic in 1987, with the exception of a subsistence whaling hunt for Greenland (Gambell, 1993; Caulfield, 1993). However, Iceland reported a catch of 136 whales in the 1988/89 and 1989/90 seasons, and has since ceased reporting fin whale kills to the IWC (Perry et al., 1999). In total, there have been 239 reported kills of fin whales from the North Atlantic from 1988 to 1995.

Like right whales and humpback whales, anthropogenic mortality of fin whales includes entanglement in commercial fishing gear and ship strikes. Of 18 fin whale mortality records collected between 1991 and 1995, four were associated with vessel interactions, although the primary cause of mortality was not known. From 1996 to July 2001, there were nine observed fin whale entanglements and at least four ship strikes. Experts believe that fin whales are struck by large vessels more frequently than any other cetacean (Laist et al., 2001).

4.1.3.5 Behavior and Susceptibility to Entanglement

As discussed, fishing gear entanglements are a source of anthropogenic mortality to fin whales. Feeding behavior may be an important component that leads to the risk of entanglement.

Fin whales exhibit lunge feeding techniques near the ocean surface, similar to humpback whales. Fin whales typically approach a prey patch horizontally, sometimes rapidly turning or rolling on their side inside a prey patch (Watkins and Schevill, 1979). Fin whales were also observed feeding below the surface and fairly close to the bottom in about 15 to 20 meters of water. NMFS analyzed entanglement data from 1996 through 2002, and found few records of well-documented fin whale entanglement events. Two out of three reported fin whale entanglements that occurred in 1997 involved buoy line (NMFS, 2001), and one of these was categorized as a serious injury (Waring et al., 2003). Based on this information, fin whales encounter gear less often than right and humpback whales. This statement is also supported by fin whale catalogs curated by College of the Atlantic and the Center for Coastal Studies, which both contain identified fin whales that lack entanglement-related scarring.

4.1.4 Minke Whale

The minke whale (*Balaenoptera acutorostrata*) is not listed as endangered or threatened under the ESA, although the species is protected under the MMPA. The total fishery-related mortality and serious injury for this stock does not exceed PBR (see below). Therefore, this is not considered a strategic stock.

4.1.4.1 Range

Minke whales off the eastern coast of the United States are considered to be part of the Canadian east coast population, which inhabits the area from the eastern half of Davis Strait south to the Gulf of Mexico. Spring and summer are times of relatively widespread and common occurrence, and during this time they are most abundant in New England waters. During fall, there are fewer minke whales in New England waters, while during winter, the species seems to be largely absent (Waring et al., 2003). Records hint at a possible winter distribution in the West Indies and in mid-ocean south and east of Bermuda (Mitchell, 1991). As with several other cetacean species, the possibility of a deep-ocean component to distribution exists but remains unconfirmed.

4.1.4.2 Life History and Reproductive Success

Minke whales reach sexual maturity between five and seven years of age (NAMMCO, 1998). Most mature females become pregnant every year. Mating occurs in the late winter and after a gestation period of 10 months, calves are born in the lower latitudes of the range (Martin et al., 1990).

4.1.4.3 Abundance

The best estimate of the population of Canadian east coast minke whales is 4,018. This figure is based on a 1999 abundance survey for the area from Georges Bank to the Gulf of St. Lawrence and a 1995 abundance survey for the Gulf of St. Lawrence. Respectively, these two surveys showed populations of 2,998 and 1,020. No more comprehensive data on minke whale abundance exist. The minimum population estimate is 3,515. The PBR for this stock of minke whales is 35 (Waring et al., 2003). Data are insufficient for determining a population trend for this species.

4.1.4.4 Factors Affecting Survival

Human-caused mortality in minke whales is relatively low in comparison to PBR for the species (35). However, fishing-related entanglements do occur. The existing data can be considered by region and fishery:

- No minke whale mortalities have been observed in the Northeast sink gillnet fishery since 1991 (Waring et al., 2003).

- Annual mortalities attributed to the Mid-Atlantic coastal gillnet fishery, as determined from strandings and entanglement records, were zero in 1991, 1992, 1994, 1995, 1996, 1997, 1999, 2000, and 2001, and one in 1998. Estimated average annual mortality related to this fishery from 1997 to 2001 was 0.2 minke whales per year (Waring et al., 2003).

- Annual mortalities attributed to the Gulf of Maine and Mid-Atlantic lobster trap/pot fishery, as determined from strandings and entanglement records that have been audited, were one in 1991, two in 1992, one in 1994, one in 1995, zero in 1996, one in 1997, and zero in 1998 to 2001. Estimated average annual mortality related to this fishery from 1997 to 2001 was 0.2 minke whales per year (Waring et al., 2003).

- Annual mortalities in unknown trawl fisheries between 1997 and 2001 include two in 1999 and zero in all other years. The mean annual mortality for unknown trawl fisheries for this time period was 0.4 (Waring et al., 2003).

- Annual mortalities attributable to unknown fisheries between 1997 and 2001 include three in 1997, three in 1999, two in 2000, and five in 2001. The mean annual mortality for unknown fisheries for this time period was 2.6 (Waring et al., 2003).

- The total mean average annual mortality due to fishery interactions from 1996 to 2000 was 3.4 minke whales per year (all in U.S. waters) (Waring et al., 2003).

Since the publication of the most recent Stock Assessment Report there have been six additional confirmed fisheries-related minke whale mortalities (three in 2001 and three in 2002) (Whittingham et al., 2003 and 2004).

4.1.4.5 Behavior and Susceptibility to Entanglement

Based on Waring et al. (2003), fishing gear entanglements account for the majority of the human-caused mortalities of minke whales. Like the other large whale species discussed, feeding behavior may be an important component that leads to entanglement risk.

Minke whales in the Northwest Atlantic typically feed on small schooling fish, such as sand lance, herring, cod, and mackerel (Ward, 1995). The whales may follow the movements of their prey and subsequently swim closer to shore and to heavy concentrations of fishing gear, making them more susceptible to entanglements. Studies conducted in the Bay of Fundy and

Gulf of St. Lawrence indicated that minke whales feed by displaying surface lunges and rolling (Sears et al., 1981; Haycock and Mercer, 1984). In contrast, a study conducted on minke whales in Cape Cod Bay and Massachusetts Bay showed a lack of surface feeding behavior (Murphy, 1995). It is likely, however, that large whales may encounter gear in any part of the water column.

The majority of documented minke whale entanglements reported by Waring et al. (2003) resulted in the death of the animal. In Waring et al. (2003), the mouth and tail stock/fluke regions were a common entanglement location for those minke whales that were seriously injured or killed.

4.2 OVERVIEW OF AFFECTED FISHERIES

The environment affected by the ALWTRP regulations includes the human environment, particularly the commercial fishing operations that must comply with the ALWTRP requirements. The affected fisheries include the following:

- American lobster;
- multispecies gillnet fisheries;
- monkfish;
- spiny dogfish;
- shark;
- coastal migratory pelagic species fisheries;
- black sea bass;
- hagfish;
- red crab;
- scup;
- Jonah crab; and
- conch/whelk.[5]

The sections below provide a baseline socioeconomic characterization of these fisheries, discussing fishery regulations, landings, revenue, numbers of permitted vessels, and key ports. The final section briefly reviews several additional fisheries that are either very small, occur primarily in waters exempted from the ALWTRP, or for which only a minor segment of the vessels fish gear that is regulated under the ALWTRP.

The analyses presented in this section are based primarily on data collected and maintained by NMFS' Northeast Regional Office, Northeast Fisheries Science Center, and Southeast Regional Office. The data represent the best available information on east coast fishing activity. Below, we describe the databases used and highlight key issues that create uncertainty in the analyses.

[5] Appendix 4-A to this chapter presents a complete listing of species landed with trap/pot gear. NMFS welcomes comments to help determine if all appropriate directed fisheries have been identified.

Northeast Dealer Data

In the Northeast, all seafood dealers handling the catch of federally-permitted vessels are required to hold dealer permits. While there is no fee for the permit, NMFS requires that dealers submit reports on the catch that they purchase. Specifically, a dealer must submit a report to NMFS for each fishing trip from which it purchased catch. Each dealer report includes information on:

- date of purchase;
- dealer name and address;
- dealer number;
- vessel name and permit number;
- pounds of each species, by market category, if applicable;
- value of each species, by market category, if applicable; and
- port landed.

Field office staff enter data into a coded form and send the data to the Northeast Fisheries Science Center to be incorporated into NMFS' larger Oracle database.

Analyses based on the dealer data warrant the following caveats:

- The purchase reports that seafood dealers submit to NMFS are not required to provide information on the gear used to land the catch reported. This information is deduced by each individual NMFS Field Office based on personal knowledge of the vessel's primary gear, the predominant species caught on the trip, or firsthand information from the fisherman. Therefore, breakouts of catch by gear type are subject to uncertainty.

- NMFS records only one gear type per dealer report. Thus, if two or more types of gear were used to catch the different species listed on the same dealer report, only the primary gear used on the trip will be noted and gear used to catch secondary species may be mischaracterized. This creates further uncertainty regarding gear types.

- Only dealers that hold Federal permits for handling certain species are required to submit dealer reports. Most notably, dealers who are only permitted to handle lobster are exempt from any reporting requirements. Thus, lobster landings may be underreported.

Southeast Logbook Data

NMFS requires all fishermen holding permits for Gulf of Mexico reef fish, South Atlantic snapper-grouper, King and Spanish mackerel, and shark to submit an individual report for every fishing trip made. Required information includes vessel data (such as vessel and crew characteristics), gear information, and catch information, including area fished and pounds landed. The characterization of affected fisheries relies on the logbook data to estimate the quantity of key southeast species caught with gear affected by ALWTRP regulations.[6]

The logbook data are subject to the following caveats:

- The logbook provides for the designation of only one gear type per species for any one trip. If more than one gear type is used for an individual species, some portion of the catch may be misattributed to the primary (recorded) gear type.

- The Southeast logbook program does not require fishermen to provide information on the value of their landings. Thus, this information is not available for southeast fisheries.

Permit Data

Fishermen are required to hold permits to fish for all federally managed species.[7] Permit requirements are included as part of the Fishery Management Plans developed by the Regional Fishery Management Councils and/or the Atlantic States Marine Fisheries Commission (ASMFC) and implemented by NMFS. Permit data are collected when fishermen apply to renew their fishing permits. NMFS' Northeast and Southeast Regional offices maintain separate permit databases.

The characterization of affected fisheries relies on permit data to identify the number of vessels that may target a particular species. The analysis distinguishes between commercial and charter/party permits using permit category data. Because fishermen may not actually target all species for which they hold permits, this approach may lead to an overestimate of the number of vessels actively involved in a fishery.

The analysis also relies on permit data to identify the number of vessels likely to fish with gear regulated under the ALWTRP. When applying for permits in the Northeast, fishermen are required to indicate what gear they are likely to use, although they are not restricted to the use of this gear (unless stipulated in the FMP). As a result, the permit database indicates the gear the permit holder intended to use when the permit application was filed, not necessarily the gear currently used. The degree of inaccuracy that stems from this data limitation is unknown, but is

[6] This analysis refers to gear types as being "affected by ALWTRP regulations." However, it is important to note that these gears are not all currently regulated under ALWTRP. Thus, "ALWTRP affected gear" refers to those gear types currently or potentially regulated by the ALWTRP.

[7] Fisheries may be managed by NMFS or by cooperative agreement between NMFS and the individual states.

likely minor. In addition to the caveat above, it is important to note that permit applications can designate multiple gear types (ranked by likelihood of use). For the purpose of characterizing affected fisheries, the analysis examines the distribution of permits by both primary gear (i.e., the gear that the permit holder is most likely to use) and all gear noted on the permit application. This approach provides a more accurate indication of the number of vessels that may be affected by ALWTRP requirements.

Permit data provided by the Southeast Regional Office does not itemize "gear types permitted" in the case of general species/fishery specific commercial permits. However, certain gear-specific permits are required to fish for certain species with specific gear types (e.g., to fish for king mackerel with a gillnet, one must hold a "Gillnet Endorsement for King Mackerel" permit). Thus, we are not able to estimate the number of fishermen permitted to fish with specific gear types for fisheries that are primarily based in the Southeast.

4.2.1 American Lobster

The American lobster, *Homarus americanus*, is a bottom-dwelling, marine crustacean characterized by a shrimp-like body and ten legs, two of which are enlarged to serve as crushing and gripping appendages. American lobster are widely distributed over the continental shelf of North America. Inshore, they are most abundant from Maine through New Jersey with abundance declining from northern to southern areas. Offshore, lobsters occur in U.S. waters from Maine through North Carolina (Atlantic States Marine Fisheries Commission, August 19, 2003). The inshore fishery dominates the industry, accounting for approximately 86 percent of total U.S. landings in 1993 (Atlantic States Marine Fisheries Commission, 1997).

Lobster growth and reproduction are linked to the molting cycle. Lobsters are encased in a hard external skeleton that provides body support and protection. Periodically, this skeleton is cast off to allow body size to increase and mating to take place. Eggs (7,000 to 80,000) are extruded and carried under the female's abdomen during a 9 to 11 month incubation period. The eggs hatch during late spring or early summer and the pelagic larvae undergo four molts before attaining adult characteristics and settling to the bottom. Lobsters typically reach legal, commercial size after five to seven growing seasons, or approximately 20 molting cycles.

Several gear types are used in the American lobster fishery, but the majority of landings are associated with traps/pots. In 1994, less than 1.3 percent of lobsters were landed by gear other than traps/pots, and the average percentage of landings from the non-trap sector for the thirty-year period between 1964-1994 was 5.74 percent (Atlantic States Marine Fisheries Commission, 1997). Traps/pots may be set singly, each having its own surface line and buoy, or in multiple-trap/pot "trawls" where the traps/pots are linked together by groundlines, with surface lines and buoys (or high flyers) at the first and/or last trap/pot. Traps/pots are further divided into general categories: inshore traps/pots and offshore traps/pots. Inshore trapping/potting typically involves smaller vessels fishing in coastal waters of depths up to 50 fathoms. In contrast, offshore, or deep-sea trapping/potting, usually involves much larger vessels using much heavier traps/pots and stronger line (Sainsbury, 1971).

Harvest levels of American lobster first prompted concern in the 1970s, resulting in the first Fishery Management Plan (FMP) for the American lobster, adopted in 1983. This first FMP called for fishing effort limits, minimum carapace size requirements, a prohibition on the possession of egg-bearing (or "berried") lobsters, and a prohibition on landing lobster parts. Since that time, a number of plan amendments have been developed for both state and Federal waters. In December 1999, NMFS issued a Final Rule (64 FR 68228) transferring the Federal lobster fishery regulations created under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (50 CFR Part 649) to the state-oriented Atlantic Coastal Fisheries Cooperative Management Act (Atlantic Coastal Act) (50 CFR Part 697). This decision recognized that the Federal FMP, which covered only Federal waters, was insufficient to address overfishing.

Currently, the inshore American lobster fishery is managed under Amendment 3 of the Atlantic States Marine Fisheries Commission's American Lobster Management Plan, as well as Addenda I, II, III, IV, and V to the plan. Adopted in December 1997, primary regulatory measures under Amendment 3 include carapace size limits, protection of ovigerous females, gear restrictions, and nominal effort control measures. In addition, Amendment 3 created seven lobster management areas (see Exhibit 4-1). These include the Inshore Gulf of Maine (Area 1), Inshore Southern New England (Area 2), Offshore Waters (Area 3), Inshore Northern Mid-Atlantic (Area 4), Inshore Southern Mid-Atlantic (Area 5), New York and Connecticut State Waters (Area 6), and Outer Cape Cod. Lobster Conservation Management Teams (LCMTs), composed of industry representatives, were formed for each management area. They advise the American Lobster Management Board and recommend changes to the management plan within their area.

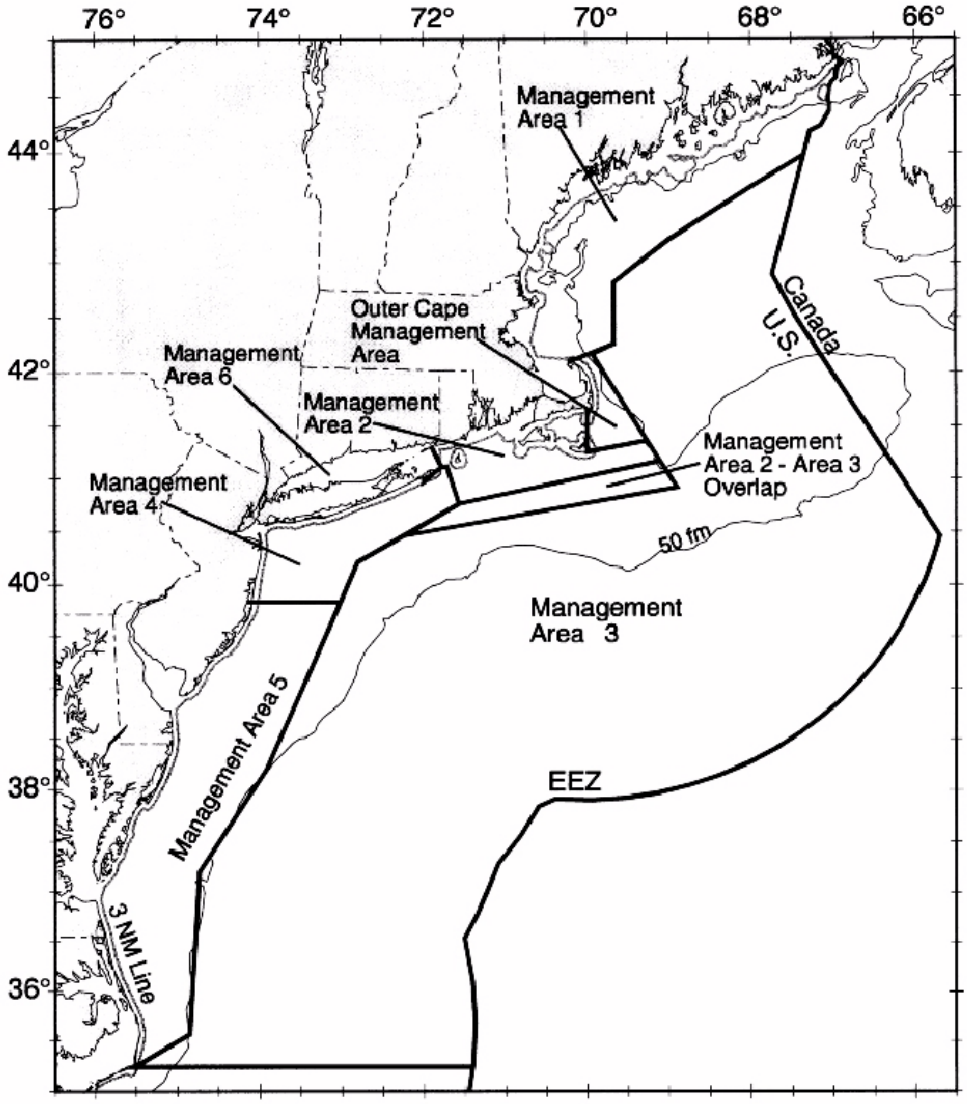
Under Federal regulations for the American lobster fishery, both state and Federal permits are limited access. Federal permit holders are required to declare annually which of the seven lobster areas they intend to fish. Any permit holder may select Areas 1, 2, 6, or the Outer Cape Management area, but only those meeting historic activity requirements may select Areas 3, 4, or 5.[8] Vessels can specify more than one management area and may fish in any area specified, but must abide by the most restrictive management measures in effect for any one of the specified areas, regardless of where they are actually fishing. In the 2002 fishing year (FY), there were 3,311 vessels federally permitted to fish for lobster (a fishing year extends from May 1 to April 30). The number of commercial trap/pot vessels that hold Federal permits for each lobster management area is presented in Exhibit 4-2.

[8] In December 2003 the Atlantic States Marine Fisheries Commission approved historical requirements for Area 2 and the Outer Cape Lobster Management Area. However, a formal rulemaking process must occur before these requirements are implemented at the Federal level.

Exhibit 4-1

AMERICAN LOBSTER MANAGEMENT AREAS

American lobster Management Areas established for the purpose of regional lobster management.



NOAA Fisheries
Northeast Regional Office
Gloucester, MA

Exhibit 4-2

FEDERAL COMMERCIAL LOBSTER TRAP/POT PERMITS BY LOBSTER MANAGEMENT AREA[1], FY2002[2]

Lobster Management Area	Number of Permits / Permitted Vessels
1	2,006
2	736
2/3 overlap	1,365
3	968
4	329
5	248
6	66
Outer Cape	258

Note:
[1] Note that a single permit is often issued for more than one area.
[2] Permits are issued by fishing year (FY). FY 2002 extended from May 1, 2002 to April 30, 2003.

Source: Permit data provided by NMFS, Northeast Region, Fisheries Statistics Office.

Each state sets its own requirements for trapping/potting lobsters in state waters. State-permitted operators who wish to fish in Federal waters must also hold a Federal permit and abide by the more restrictive of the two (Federal or state) regulations.

Lobster has consistently ranked among the Atlantic coast's most commercially important species. In 2001, American lobster contributed the greatest percentage of the region's total ex-vessel fishing revenue, accounting for 21 percent of Atlantic coast revenue and 37 percent of New England revenue.[9] Revenues increased the next year, from $251.2 million to $287.8 million, reflecting an increase in landings of approximately 10 million pounds. Additional detail on annual lobster landings and ex-vessel revenue is presented in Exhibit 4-3.

Exhibit 4-3

LANDINGS AND REVENUE FOR THE AMERICAN LOBSTER FISHERY: 1998-2002

Fishing Year	Landings (million lbs)	Revenue ($ millions)
1998	80.09	255.1
1999	89.16	329.5
2000	86.93	314.3
2001	71.61	251.2
2002	81.01	287.8

Source: NMFS, 2003d.

[9] Ex-vessel value refers to the amount of revenue received by fishermen or harvesters (i.e., the amount received from the first post-landing transaction).

The greater abundance of lobster in northern waters is reflected in the distribution of landings by state. Maine consistently accounts for the greatest share of the lobster catch, with landings in 2002 of 60.7 million pounds. Massachusetts, the second leading producer, had landings in 2002 of 12.9 million pounds. Together, Maine and Massachusetts accounted for about 89 percent of total national landings. Lobster landings and revenue by state for 2002 are presented in Exhibit 4-4.

Exhibit 4-4

LOBSTER LANDINGS AND REVENUE BY STATE: 2002

State	Landings (lbs)	Landings (% of Total)	Revenues ($)	Revenues (% of Total)
Maine	60,729,911	73.83%	$202,084,579	68.89%
Massachusetts	12,855,070	15.63%	$56,575,915	19.29%
Rhode Island	3,835,160	4.66%	$15,875,521	5.41%
New Hampshire	2,030,032	2.47%	$8,164,364	2.78%
New York	1,440,483	1.75%	$5,131,295	1.75%
Connecticut	1,067,121	1.30%	$4,225,522	1.44%
New Jersey	264,425	0.32%	$1,138,867	0.39%
Maryland	20,489	0.02%	$95,174	0.03%
Virginia	7,856	0.01%	$34,739	0.01%
Delaware	551	<0.01%	$2,625	<0.01%
TOTAL	82,251,098	100.00%	$293,328,601	100.00%

Note: Weight and revenue figures derived using the 2002 dealer data differ slightly from those derived using NMFS' on-line Annual Commercial Landing Statistics.

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

Exhibit 4-5 provides additional data on the distribution of lobstering activity, highlighting the top grossing ports for lobster in 2002. As shown, several Maine ports account for a significant portion of the total lobster catch. However, most lobster is landed at smaller ports along the New England coast, rather than at a single dominant port.

Exhibit 4-5

LOBSTER LANDINGS VALUE BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings ($)
Vinalhaven	Knox	ME	20,100,873
Stonington	Hancock	ME	19,907,762
Portland	Cumberland	ME	12,896,344
Gloucester	Essex	MA	10,110,800
Other Knox County ports	Knox	ME	9,891,649
Other Ports			220,421,173
TOTAL			293,328,601

Notes:

[1] Ports are listed in descending order based on the value of total landings. The top five ports are presented in this exhibit.

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.2 Northeast Multispecies

The Northeast Multispecies Fishery Management Plan (FMP) governs commercial fishing in New England and Mid-Atlantic waters for fifteen species (and 24 stocks) of demersal fish. These species, which are listed in Exhibit 4-6, are grouped together under one FMP because the fish share common habitats and are often caught at the same time. They are present in shallow coastal areas, deep waters, and ocean banks such as Georges and Stellwagen Banks. The majority of the commercial fishing activity targeting these species occurs in the Northeast, where cooler waters support a greater abundance of groundfish. For more information on each species regulated under the Multispecies FMP, including common and scientific names, a brief summary of key biological facts relevant to each species, commercial uses, and a drawing of a representative member of each species, see Appendix 4-B.

Exhibit 4-6

SPECIES/STOCKS MANAGED UNDER THE NORTHEAST MULTISPECIES FISHERY MANAGEMENT PLAN

Species	Associated Stocks
American plaice	One stock: distributed primarily in the Gulf of Maine.
Atlantic cod	Two stocks: Gulf of Maine cod and Georges Bank cod.
Atlantic halibut	One stock: distributed primarily in the Gulf of Maine and on Georges Bank.
Haddock	Two stocks: Gulf of Maine haddock and Georges Bank haddock.
Ocean Pout	One stock: distributed throughout the region.
Offshore hake	One stock: distributed primarily offshore in southern New England and the Mid-Atlantic.
Pollock	One stock: distributed in the Gulf of Maine, Georges Bank, and southern New England regions.
Red hake (ling)	Two stocks: Gulf of Maine/northern Georges Bank red and southern Georges Bank/southern New England red.
Redfish	One stock: distributed primarily in the Gulf of Maine and southern Georges Bank.
Silver hake (whiting)	Two stocks: Gulf of Maine/northern Georges Bank whiting and southern Georges Bank/southern New England whiting.
White hake	One stock: distributed primarily in the Gulf of Maine and southern Georges Bank.
Windowpane flounder	Two stocks: Gulf of Maine/Georges Bank windowpane and southern New England/Mid-Atlantic windowpane.
Winter flounder	Three stocks: Gulf of Maine winter, Georges Bank winter, and southern New England/Mid-Atlantic winter.
Witch flounder	One stock: distributed primarily in the Gulf of Maine and on Georges Bank.
Yellowtail flounder	Three stocks: Georges Bank yellowtail, Cape Cod yellowtail, and southern New England yellowtail.

Source: NEFMC, 2003a.

The Northeast Multispecies FMP was adopted in 1986 and has been modified by numerous amendments and framework adjustments. Management measures currently include a limited access permit system, gear restrictions, seasonal and full-time area closures, days-at-sea allocations, trip limits, minimum fish sizes, and reporting requirements. The fishery is currently being managed under Amendment 13, which went into effect on May 1, 2004.

In FY2000, 3,901 multispecies permits were issued. This includes active and inactive permits, as well as limited and open access permits. Open access permits include handgear, party/charter, scallop, multispecies 300-pound possession limit, and non-regulated multispecies (small mesh multispecies and halibut) permits. Most full-time commercial groundfish vessels hold limited access permits. Of the groundfish permits issued in FY2000, 1,655 were limited access and 1,971 were open access.[10] The breakdown of permits issued, by permit type, is presented in Exhibit 4-7. Active vessels are those vessels that landed any amount of fish (not just groundfish) in a given year. As shown, in FY2000, there were 1,931 active groundfish vessels.

Exhibit 4-7

MULTISPECIES PERMITS AND VESSEL ACTIVITY, FY2000

Permit Type	Permit Category	Permits Issued	Active Vessels
Limited Access Permits			
Individual Days at Sea	A	134	130
Fleet Days at Sea	B	1,245	903
Small Vessel Exemption	C	14	7
Hook Gear Only	D	186	96
Combination Vessel (scallops and groundfish)	E	47	45
Large Mesh Individual and Fleet Days at Sea	F, G	29	26
Open Access Permits	H, I, J, K	1,971	704
Unknown Category		275	20
TOTAL		3,901	1,931
Source: NEFMC, 2003b.			

Most multispecies vessels range in size from 30 to 49 feet. Based on information from FY2000, the breakdown of vessel length is as follows:

- Approximately 21 percent of groundfish vessels are less than 20 feet;
- Approximately 52 percent of groundfish vessels are from 30 to 49 feet;
- Approximately 17 percent of groundfish vessels are from 50 to 74 feet; and
- Approximately 10 percent of groundfish vessels are 75 feet or longer.

In FY2002, 4,058 vessels possessed Northeast multispecies permits (2,153 vessels held commercial permits that allow the use of gear types currently or potentially subject to ALWTRP requirements; 2,297 vessels held other commercial permits; and 687 vessels held charter/party permits). Exhibit 4-8 presents the total number of permitted vessels, by gear type and primary gear type, for all permit categories. The most prevalent primary gear type is "other gear" – which includes hand lines, rod and reel, harpoons, diving gear, and other unspecified gear types – followed by bottom trawls. Only 399 vessels (9.9 percent) holding Northeast multispecies

[10] An additional 275 permits of an unknown category were issued in 2000.

permits in FY2002 indicated ALWTRP regulated gear (gillnets, traps/pots) as the primary gear (see shading).

Exhibit 4-8

PERMITTED NORTHEAST MULTISPECIES VESSELS, FY2002 [1]

Gear Name	By All Gear		By Primary Gear	
	Number	% of Total	Number	% of Total
Purse Seine	17	0.4%	4	0.1%
Beach Seine	4	0.1%	0	0.0%
Boat Seine	15	0.4%	3	0.1%
Bottom Trawls	1,181	29.1%	1,004	24.7%
Mid-Water Trawls	241	5.9%	8	0.2%
Other Trawls	227	5.6%	17	0.4%
Dredge	181	4.5%	148	3.6%
Gill/Entangling Nets[2]	647	15.9%	347	8.6%
Pots and Traps[2]	132	3.3%	52	1.3%
Longlines and Setlines	519	12.8%	212	5.2%
Other Gear [3]	2,740	67.5%	2,418	59.6%
ALL GEAR TYPES [4]	4,058	100.0%	4,058	100.0%

Notes:

[1] Permits are issued by fishing year (FY). FY 2002 extended from May 1, 2002 to April 30, 2003.

[2] Shading indicates that ALWTRP regulated gear was identified as the primary gear.

[3] Includes hand lines, rod and reel, harpoons, diving gear, and other gear types.

[4] Number of vessels for each gear type will not sum to number of vessels for "all gear types" because vessels may be permitted to fish using multiple gear types.

Source: Data provided by NMFS, Northeast Region, Fisheries Statistics Office.

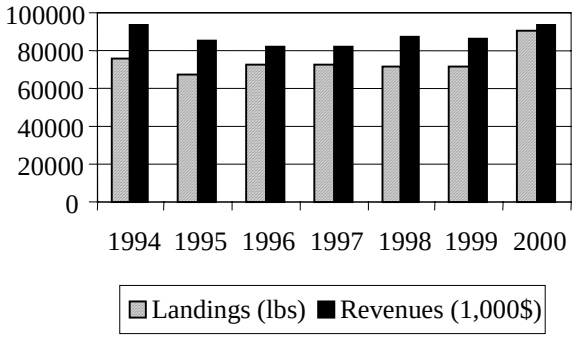
In FY2000, total landings in the multispecies groundfish fishery were approximately 120.3 million pounds (90.0 million pounds of large mesh species; 30.3 million pounds of small mesh species).[11] The total value of 2000 landings was approximately $105.7 million ($93.4 million for large mesh species; $12.3 million for small mesh species). Exhibit 4-9 presents landings of large-mesh species, by value and by weight, for FY1994 through FY2000. As shown, landings have been relatively steady during this period.

A total of 111.6 million pounds of Multispecies FMP-regulated fish were landed in the Northeastern U.S. in 2002. Otter trawls were used to catch the greatest percentage of fish, roughly 86 percent (see Exhibit 4-10). Of the total landings, 11.3 million pounds (10 percent) were caught using gear that is subject to the requirements of the ALWTRP.

[11] The Northeast Multispecies FMP separates fish into small-mesh and large-mesh species based on the size of net typically used to fish for each species. Large-mesh species are American plaice, Atlantic cod, Atlantic halibut, haddock, ocean pout, pollock, redfish, white hake, windowpane flounder, winter flounder, witch flounder, and yellowtail flounder. Small-mesh species are offshore hake, red hake, and silver hake.

Exhibit 4-9

LARGE MESH LANDINGS AND REVENUES, FY1994 TO FY2000



Source: NEFMC, 2003b.

Exhibit 4-10

LANDINGS FOR THE NORTHEAST MULTISPECIES FISHERY BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Otter Trawl	95,856,031	85.93%
Fixed or Stake/Set Gillnet	11,284,721	10.12%
Bottom Longline	2,001,744	1.79%
Handline	1,356,632	1.22%
Unknown	663,230	0.59%
Other	392,962	0.35%
TOTAL	111,555,320	100.00%

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

As shown in Exhibit 4-11, the ex-vessel value of landings for species managed under the Northeast Multispecies FMP totaled $113.7 million in 2002. Approximately 12 percent of this revenue is attributable to fish caught with ALWTRP affected gear. More than half of the groundfish were landed at Massachusetts ports; significant landings are also reported for Portland, Maine. The majority of landings in Chatham, Massachusetts are associated with ALWTRP affected gear, whereas ALWTRP affected gear accounts for a smaller share of landings in other ports.

Exhibit 4-11

VALUE OF LANDINGS FOR THE NORTHEAST MULTISPECIES FISHERY BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings	Total Value of Fish Caught with ALWTRP Affected Gear[2]	Percent of Revenues Attributable to ALWTRP Affected Gear
New Bedford	Bristol	MA	$41,975,703	$23,726	0.06%
Gloucester	Essex	MA	$19,211,453	$3,867,770	20.13%
Portland	Cumberland	ME	$15,544,203	$2,422,135	15.58%
Chatham	Barnstable	MA	$4,905,828	$3,090,459	63.00%
Boston	Suffolk	MA	$4,659,474	$405	0.01%
Other Ports			$27,436,478	$3,830,967	13.96%
TOTAL			$113,733,139	$13,235,462	11.64%

Notes:

1 Ports are listed in descending order based on the value of landings. The top five ports are presented in this exhibit.

2 Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.3 Monkfish

Monkfish (also called goosefish or anglerfish), *Lophius americanus*, occur from the southern and eastern Grand Banks (Newfoundland) and the northern Gulf of St. Lawrence to the east coast of Florida (to about 29°00′ N latitude), but are common only north of Cape Hatteras. Monkfish have been found in depths ranging from the tide line to 840 meters, although the greatest concentrations occur between 70 and 100 meters, and in deeper water at about 190 meters. Females live approximately 12 years and reach an average size of just over 100 centimeters, while males have rarely been found older than six years and reach lengths of approximately 90 centimeters.

The New England Fishery Management Council (NEFMC) and the Mid-Atlantic Fishery Management Council (MAFMC) work together to develop measures for management of the monkfish fishery in Federal waters under the Magnuson-Stevens Act. Regulations to implement the Monkfish FMP became effective, in part, in November 1999 (the remainder on May 1, 2000) and include separation of the management unit into two management areas (the Northern Fishery Management Area and the Southern Fishery Management Area), limited access vessel permits, dealer and operator permits, trip limits, days-at-sea (DAS) allocations, reporting requirements, and gear restrictions (including a limit on the number and length of gillnets fished, a gillnet tagging requirement, and a minimum mesh size for gillnets). The principal gear types used in the commercial monkfish fishery are trawl and sink gillnet gear (see below). Scallop dredge gear has contributed substantially to monkfish landings in the past, but the FMP now prohibits targeted monkfish fishing using scallop dredge gear.

In addition to measures promulgated under the FMP, operation of the gillnet sector of the monkfish fishery is further modified by management measures developed under the ALWTRP, the Harbor Porpoise Take Reduction Plan, and the ESA Final Rule for Large-Mesh Gillnet Fisheries. Cumulatively, these measures provide for additional gear restrictions and seasonal area closures to reduce interactions between monkfish (and other gillnet fisheries) and large whales, sea turtles, and harbor porpoise.

The management unit (over which permits are granted) for monkfish extends throughout the portion of its principal range in U.S. waters, from Maine to Cape Hatteras, North Carolina. The limited access program restricts participation in the monkfish fishery to those boats with sufficient landings during a qualification period. During FY2002, 729 vessels qualified for monkfish limited access permits and 2,142 vessels received incidental catch permits. Exhibit 4-12 presents the number of vessels permitted to fish monkfish, by gear type and primary gear type. The prevalent primary gear type among permitted vessels is the bottom trawl, followed by "other gear" and gill/entangling nets. A total of 647 vessels (approximately 22.7 percent) holding monkfish permits indicated an ALWTRP affected gear as their primary gear.

Exhibit 4-12

PERMITTED MONKFISH VESSELS, FY2002 [1]

	By All Gear		By Primary Gear	
Gear Name	**Number**	**% of Total**	**Number**	**% of Total**
Purse Seine	10	0.4%	3	0.1%
Beach Seine	4	0.1%	0	0.0%
Boat Seine	12	0.4%	2	0.1%
Bottom Trawls	1,338	46.9%	1065	37.3%
Mid-Water Trawls	320	11.2%	7	0.2%
Other Trawls	358	12.5%	28	1.0%
Dredge	453	15.9%	266	9.3%
Gill/Entangling Nets[2]	1,032	36.1%	585	20.5%
Pots and Traps[2]	144	5.0%	62	2.2%
Longlines and Setlines	480	16.8%	123	4.3%
Other Gear [3]	1,144	40.1%	739	25.9%
ALL GEAR TYPES [4,5]	2,855	100.0%	2,852	100.0%

Notes:

1 Permits are issued by fishing year (FY). FY 2002 extended from May 1, 2002 to April 30, 2003. Permits are valid for the monkfish management unit, which extends from Maine to Cape Hatteras, North Carolina.

2 Shading indicates that ALWTRP regulated gear was identified as the primary gear.

3 Includes hand lines, rod and reel, harpoons, diving gear, and other gear types.

4 Number of vessels for each gear type will not sum to number of vessels for "all gear types" because vessels may be permitted to fish using multiple gear types.

5 The number of vessels using all gear types should be the same for "All Gear" and for "Primary Gear." The small difference shown above is likely due to a coding irregularity in the original source data.

Source: Data provided by NMFS, Northeast Region, Fisheries Statistics Office.

Roughly 28.3 million pounds of monkfish were landed in the Northeastern U.S. in 2002. Fixed or stake gillnets (considered "anchored gillnets" under ALWTRP requirements) and otter trawls were used to catch the greatest percentage of monkfish, 53 percent and 41 percent, respectively (see Exhibit 4-13). Of the total landings, about 15 million pounds (53 percent) were caught using ALWTRP regulated gear (fixed and drift gillnets).

Exhibit 4-13

MONKFISH LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Fixed or Stake/Set Gillnet	15,066,207	53.17%
Otter Trawl	11,748,414	41.46%
Scallop Dredge	1,417,152	5.00%
Drift Gillnet	33,918	0.12%
Bottom Longline	32,237	0.11%
Other	35,943	0.13%
TOTAL	28,333,871	100.00%

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

The ex-vessel value of monkfish landings in the Northeast totaled approximately $37 million in 2002. Of this total, 54 percent came from fish caught with ALWTRP affected gear. Exhibit 4-14 summarizes the top grossing ports for monkfish in 2002. As shown, landings are distributed among a variety of Northeastern ports. Vessels landing their catch at several of these ports, particularly Long Beach/Barnegat Light, New Jersey, depend heavily upon ALWTRP affected gear.

Exhibit 4-14

VALUE OF MONKFISH LANDINGS BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings ($)	Total Value of Fish Caught with ALWTRP Affected Gear[2] ($)	Percent of Revenues Attributable to ALWTRP Affected Gear
New Bedford	Bristol	MA	6,567,550	1,516,037	23.08%
Portland	Cumberland	ME	4,990,587	392,047	7.86%
Gloucester	Essex	MA	4,328,985	2,469,730	57.05%
Long Beach/ Barnegat Light	Ocean	NJ	3,870,007	3,785,019	97.80%
Point Judith	Washington	RI	2,315,556	1,703,002	73.55%
Other Ports			15,149,158	10,297,898	67.98%
TOTAL			37,221,843	20,163,733	54.17%

Notes:

1 Ports are listed in descending order based on the value of landings. The top five ports are presented in this exhibit.

2 Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.4 Spiny Dogfish

Spiny dogfish, *Squalus acanthias*, is a shark belonging to the class Chondrichthyes (cartilaginous fishes). They can be found on both sides of the Atlantic. In the Northwest Atlantic, they range from Florida to Labrador, but are most abundant from Nova Scotia to Cape Hatteras. The Northwest Atlantic stock tends to spend summer months in waters from Massachusetts to Canada and the remainder of the year entirely in U.S. waters. Spiny dogfish are landed in every state from Maine to North Carolina and in all months of the year. During the fall and winter months, spiny dogfish are taken principally in Mid-Atlantic waters and southward from New Jersey to North Carolina. During the spring and summer months, spiny dogfish are landed mainly in northern waters from New York to Maine (Atlantic States Marine Fisheries Commission, 2002).

The New England Fishery Management Council (NEFMC) and the Mid-Atlantic Fishery Management Council (MAFMC) work together to develop measures for management of the spiny dogfish fishery in Federal waters under the Magnuson-Stevens Act. Regulations to implement the Spiny Dogfish Fishery Management Plan (FMP) became effective February 2000, and include permitting requirements for vessels (open access permit), dealers, and vessel operators. The regulations implementing the FMP also require establishment of an annual commercial quota subdivided into two semi-annual periods. All spiny dogfish landed for a commercial purpose from Maine through Florida must be applied against the commercial quota, regardless of where the spiny dogfish were caught. The fishery is closed for the remainder of the quota period once the quota available for that period has been harvested. Since spiny dogfish are also commercially fished in state waters where the ASMFC has primary oversight, the ASMFC has developed an Interstate Fishery Management Plan (ISFMP) for spiny dogfish. That plan was approved in late 2002 and implemented by each state beginning May 1, 2003 (consistent with the start of the 2003 spiny dogfish fishing year under the Federal FMP).

Because of mortality rates, the Spiny Dogfish FMP contains a restrictive rebuilding schedule allowing only limited, incidental catch of dogfish until the stock is rebuilt. For the period from May 1, 2000 through April 30, 2002, the annual quota was set at 4 million pounds, with trip limits of 600 pounds and 300 pounds for quota periods I and II, respectively. NMFS proposed the same annual quota and trip limits for the 2003 fishing year beginning May 1, 2003. However, the Spiny Dogfish and Coastal Shark Management Board of the ASMFC approved an annual quota of 8.8 million pounds and coast-wide trip limit of 7,000 pounds for state waters in the 2003 fishing year. Discussions on management of the fishery given the differences in quotas are on-going.

Exhibit 4-15 presents the number of permitted vessels by gear type and primary gear. Approximately 3,055 vessels were permitted to fish for spiny dogfish in FY2002. The most common primary gear type among permitted vessels is the bottom trawl, followed by "other gear" and gill/entangling nets. A total of 815 vessels (26.7 percent) holding spiny dogfish permits in FY2002 indicated an ALWTRP affected gear (predominantly gillnets) as the primary gear (see shading).

Exhibit 4-15

PERMITTED SPINY DOGFISH VESSELS, FY2002 [1]

Gear Name	By All Gear		By Primary Gear	
	Number	% of Total	Number	% of Total
Purse Seine	28	0.9%	15	0.5%
Beach Seine	4	0.1%	0	0.0%
Boat Seine	17	0.6%	5	0.2%
Bottom Trawls	1,327	43.4%	1,062	34.8%
Mid-Water Trawls	401	13.1%	14	0.5%
Other Trawls	388	12.7%	37	1.2%
Dredge	203	6.6%	104	3.4%
Gill/Entangling Nets[2]	1,349	44.2%	780	25.6%
Pots and Traps[2]	105	3.4%	35	1.1%
Longlines and Setlines	832	27.2%	276	9.0%
Other Gear [3]	1,234	40.4%	742	24.3%
ALL GEAR TYPES [4,5]	3,055	100.0%	3,052	100.0%

Notes:

[1] Permits are issued by fishing year (FY). FY 2002 extended from May 1, 2002 to April 30, 2003.

[2] Shading indicates that ALWTRP regulated gear was identified as the primary gear.

[3] Includes hand lines, rod and reel, harpoons, diving gear, and other gear types.

[4] Number of vessels for each gear type will not sum to number of vessels for "all gear types" because vessels may be permitted to fish using multiple gear types.

[5] The number of vessels using all gear types should be the same for "All Gear" and for "Primary Gear." The small difference shown above is likely due to a coding irregularity within the original data source.

Source: Data provided by NMFS, Northeast Region, Fisheries Statistics Office.

A total of 4.6 million pounds of spiny dogfish were landed in the Northeastern U.S. in 2002. Bottom longlines and fixed/stake gillnets were used to catch the greatest percentage of spiny dogfish, 50 percent and 38 percent, respectively (see Exhibit 4-16). Of the total landings, 1.8 million pounds (39 percent) were caught using ALWTRP affected gear.

Exhibit 4-16

SPINY DOGFISH LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Bottom Longline	2,299,079	49.53%
Fixed or Stake/Set Gillnet	1,785,786	38.48%
Otter Trawl	544,650	11.73%
Handline	7,740	0.17%
Pound Net	1,337	0.03%
Other	2,818	0.06%
TOTAL	4,641,410	100.00%

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

The ex-vessel value of spiny dogfish landings in the Northeast totaled $0.9 million in 2002. Of this total, 40 percent came from fish caught with an ALWTRP affected gear type. Exhibit 4-17 summarizes the top grossing ports for spiny dogfish in 2002. As shown, several Massachusetts ports dominate spiny dogfish landings.

Exhibit 4-17

VALUE OF SPINY DOGFISH LANDINGS BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings	Total Value of Fish Caught with ALWTRP Affected Gear[2]	Percent of Revenues Attributable to ALWTRP Affected Gear
Chatham	Barnstable	MA	$389,333	$42,946	11.03%
Plymouth	Plymouth	MA	$134,292	$133,999	99.78%
Provincetown	Barnstable	MA	$93,812	$20,267	21.60%
Point Judith	Washington	RI	$56,891	$155	0.27%
Harwichport	Barnstable	MA	$48,949	NA	0.0%
Other Ports			$211,396	$173,560	82.10%
TOTAL			$934,673	$370,927	39.69%

Notes:

[1] Ports are listed in descending order based on the value of landings. The top five ports are presented in this exhibit.

[2] Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.5 The Directed Shark Gillnet Fishery

Sharks belong to the class Chondrichthyes (cartilaginous fishes), which also includes rays, skates, and deepwater chimaeras (ratfishes). There is great diversity in size, feeding habits, behavior, and reproduction among the 350 species of sharks. Shark habitat can be described in four broad categories: (1) coastal, (2) pelagic, (3) coastal-pelagic, and (4) deep-dwelling. Coastal species inhabit estuaries, the nearshore and waters of the continental shelves, e.g., blacktip, finetooth, bull, lemon, and sharpnose sharks (which are thought to enter wetland tidal creeks). Pelagic species, on the other hand, range widely in the upper zones of the oceans, often traveling over entire ocean basins. Examples include mako, blue, and oceanic whitetip sharks. Coastal-pelagic species are intermediate in that they occur both inshore and beyond the continental shelve, but have demonstrated mid-ocean or transoceanic movements. Sandbar, scalloped hammerhead, and dusky sharks are examples of this group. Deep-dwelling sharks, e.g., most cat sharks and gulper shark inhabit the dark, cold waters of the continental slopes and deeper waters of the ocean basins. For additional information on the life history and essential fish habitat of each shark species, see Chapters 5 and 6 of the HMS FMP, and Chapter 10 of Amendment 1 to the HMS FMP.

There is extreme diversity in the more than 350 species of sharks found in the world's oceans. In the western Atlantic, thirty-nine species are managed under the HMS FMP; the spiny dogfish is managed under the authority of the Atlantic States Marine Fisheries Commission as well as the New England and mid-Atlantic Fishery Management Councils. Based on a

combination of ecology and fishery dynamics, the sharks included under the HMS FMP have been divided into four species groups for management purposes: (1) large coastal species, (2) small coastal species, (3) pelagic species, and (4) prohibited species. Exhibit 4-18 lists the shark species in each management group. Data on other species collectively categorized as 'deepwater and other sharks' (such as smooth dogfish and the catsharks) are collected, but those species are not actively managed at this time.

Exhibit 4-18
COMMON SHARK SPECIES, BY SHARK CLASS

Species Group	Common Name	Species
Large Coastal Sharks (LCS) Ridgeback Species	Sandbar	Carcharhinus plumbeus
	Silky	*Carcharhinus falciformis*
	Tiger	Galeocerdo cuvier
Non-Ridgeback Species	Spinner	*Carcharhinus brevipinna*
	Blacktip	*Carcharhinus limbatus*
	Bull	*Carcharhinus leucas*
	Lemon	Negaprion brevirostris
	Nurse	*Ginglymostoma cirratum*
	Great hammerhead	*Sphyrna mokarran*
	Scalloped hammerhead	*Sphyrna lewini*
	Smooth hammerhead	*Sphyrna zygaena*
Small Coastal Sharks (SCS)	Atlantic sharpnose	*Rhizoprionodon terraenovae*
	Blacknose	*Carcharhinus acronotus*
	Bonnethead	*Sphyrna tiburo*
	Finetooth	*Carcharhinus isodon*
Pelagic Sharks	Blue	*Prionace glauca*
	Porbeagle	*Lamna nasus*
	Shortfin mako	*Isurus oxyrinchus*
	Thresher	*Alopias vulpinus*
	Oceanic whitetip	*Carcharhinus longimanus*
Prohibited Sharks	Sand tiger	*Odontaspis taurus*
	Bigeye sand tiger	*Odontaspis noronhai*
	Whale	*Rhincodon typus*
	Basking	*Cetorhinus maximus*
	White	*Carcharodon carcharias*
	Dusky	*Carcharhinus obscurus*
	Bignose	*Carcharhinus altimus*
	Galapagos	*Carcharhinus galapagenisis*
	Night	*Carcharhinus signatus*
	Caribbean reef	*Carcharhinus perezi*
	Narrowtooth	*Carcharhinus brachyurus*
	Caribbean sharpnose	*Rhizoprionodon porosus*
	Smalltail	*Carcharhinus porosus*
	Atlantic angel	*Squatina dumerili*
	Longfin mako	*Isurus paucus*
	Bigeye thresher	*Alopias superciliosus*
	Sevengill	*Heptranchias perlo*
	Sixgill	*Hexanchus griseus*
	Bigeye sixgill	*Hexanchus vitulus*

Source: Final Amendment 1 to the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks, NMFS, 2003.

Sharks were first managed in 1993 under NMFS' Fishery Management Plan (FMP) for Sharks of the Atlantic Ocean. This 1993 FMP was replaced in 1999 when NMFS published the final FMP for Atlantic Tunas, Swordfish and Sharks (also called the Highly Migratory Species (HMS) FMP). All Federal fisheries for sharks, except spiny dogfish, are managed under the HMS FMP. The HMS FMP contains numerous measures to rebuild or prevent overfishing of Atlantic sharks in commercial and recreational fisheries, including permitting and reporting requirements, quotas for commercial landings, recreational bag limits, fishery closures, minimum size requirements, limited access, and a list of prohibited shark species. NMFS recently amended the HMS FMP, and published a final rule for Amendment I to the FMP in the Federal Register on December 24, 2003 (68 FR 74746). On April 15, 2004, NMFS published a notice in the Federal Register that identified NOAA-approved Vessel Monitoring System (VMS) devices for use by vessels participating in all of the Atlantic HMS fisheries and vessels participating in the Southeast shark gillnet fishery (69 FR 19979). A proposed rule to identify an effective date for the VMS requirement published on May 18, 2004 (69 FR 28106).

In the Atlantic Ocean, the directed shark fishery is most active in southern waters from Georgia to Florida. As of October 2003, 610 vessels possessed permits to fish for shark. Of these vessels, 359 had incidental shark permits, and 251 had directed shark permits. However, only six permit holders have been known to use gillnet gear to target sharks in recent years.[12]

Therefore, while all dealer data analyzed for 2002 indicates that roughly 675,000 pounds of shark were caught in the southeast with ALWTRP-affected gillnet gear[13], it is most likely that the majority of these landings are the result of sharks as bycatch in gillnet fisheries targeting other species. For the six vessels involved in the directed shark gillnet fishery, landings were much lower. During the 2002 right whale season (November 15 - March 31) for which 100% observer coverage was required, the total catch equaled approximately 10,200 sharks[14]. While about half of these were blacktip (large coastal) sharks, the remainder were primarily small coastal sharks, weighing less than ten pounds each. During the non-right whale season for 2002 (April 1 – November 14) for which 50% observer coverage was required, approximately 12,000 sharks were caught. Of these, only 1,119 were blacktips, with the remainder being small coastal species. Thus, the dealer data alone does not accurately reflect the actual landings from the directed shark gillnet fishery.

4.2.6 Coastal Migratory Pelagic Species

Coastal pelagic species are characterized as coastal, fast swimming, fast-growing, schooling fishes (Hoese, H.D. and Moore, R.H., 1977). Coastal pelagic fishes inhabiting waters off the southeastern United States include Spanish mackerel (*Scomberomorus maculatus*), king mackerel (*Scomberomorus cavalla*), cero mackerel (*Scomberomorus regallis*), bluefish

[12] Based on information found in the 2004 Stock Assessment and Fishery Evaluation Report for Atlantic Highly Migratory Species and Amendment 1 to the FMP for Atlantic Tunas, Swordfish, and Sharks.

[13] According to an analysis of dealer data provided by Northeast Regional Office, National Marine Fisheries Service.

[14] As reported in Carleson and Baremore, 2002a and Carleson and Baremore, 2002b.

(*Pomatomus saltatrix*), cobia (*Rachycentron canadum*), little tunny (*Ethynnus alletteratus*), and the common dolphin-fish (*Coryphaena hippurus*). These species range in coastal and continental shelf waters from the Northeastern United States to Brazil. King and Spanish mackerel are major target species of important commercial fisheries in Florida and North Carolina, as well as major target species for the private boat and charter boat recreational fishery in the South Atlantic region. Small amounts of king and Spanish mackerel are caught as an incidental catch or supplemental commercial target species off Georgia and South Carolina. Spanish mackerel is landed primarily by run-around gill nets, other gill nets, and to a lesser extent, hook and line. Most king mackerel landed in the South Atlantic region are taken by hook and line gear. Of the coastal pelagic species, only mackerel and bluefish (not regulated under any Fishery Management Plan in the southeast Atlantic) are caught in significant quantities by gillnets.[15]

The Fishery Management Plan (FMP) for Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic is jointly managed by the South Atlantic and Gulf of Mexico Fishery Management Councils (GMFMC and SAFMC, 1983). The plan was approved in 1982 and implemented by regulations effective in February of 1983. Regulations implemented under the FMP address king and Spanish mackerel, little tunny, bluefish (in the Gulf of Mexico only), and cobia. The plan treats king and Spanish mackerel each as one U.S. stock. The present management regime for mackerel recognizes two migratory groups of king and Spanish mackerel: the Gulf Migratory Group and the Atlantic Migratory Group. King mackerel from these two groups seasonally mix on the East Coast of Florida.

Fishing season for king and Spanish mackerel is open year-round until the annual landings quota is filled (3.71 million pounds for king mackerel; 3.87 million pounds for Spanish mackerel). An annual permit is required to fish under the commercial quota for these species. A moratorium on the issuance of king mackerel permits is now in effect until October 15, 2005. Although coastal migratory pelagic species occur in the Mid-Atlantic, it is believed that the quantities of regulated species there are too small to warrant regulation. Therefore, permits issued under the Coastal Migratory Pelagic FMP apply only within the Fishery Conservation Zone within the jurisdiction of the Gulf of Mexico and South Atlantic Fishery Management Councils. Also, although Spanish mackerel, king mackerel, cero mackerel, bluefish (in the Gulf of Mexico), cobia, little tunny, and the common dolphin-fish are all managed under the Coastal Migratory Pelagic FMP, only king and Spanish mackerel have commercial permitting requirements.[16] Charter vessels must be permitted to fish for any of the regulated species.

During the 2002 calendar year, 3,269 vessels possessed permits to fish for coastal migratory pelagic species. The breakdown of vessels by permit type is presented in Exhibit 4-19. Vessels may have multiple permits.

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[15] Landings of each of the other coastal pelagic species account for less than one percent of the total gillnet catch in the southeast. King mackerel and cero mackerel are grouped together for the purposes of this analysis, which is based on data provided by NMFS' Southeast Regional Office.

[16] No permit is required for bluefish in the Gulf of Mexico. In the western Atlantic, bluefish are regulated under the Bluefish Fishery Management Plan, under the authority of the Mid-Atlantic Fishery Management Council.

Exhibit 4-19

VESSELS POSSESSING COASTAL MIGRATORY PELAGIC PERMITS IN 2002, BY PERMIT TYPE

Permit Type[1]	Number of Vessels
Charter Vessels [2]	2,166
King Mackerel (commercial)	1,340
King Mackerel (gillnet endorsement)	21
Spanish Mackerel (commercial)	1,077

Notes:

[1] Permit data provided by the Southeast Regional Office does not itemize "gear types permitted" in the case of general species/fishery specific commercial permits. However, certain gear-specific permits are required to fish for certain species with specific gear types (e.g., in order to fish for king mackerel with a gillnet, one must hold a "Gillnet Endorsement for King Mackerel" permit).

[2] Includes the following permit types: "Charter Vessel for Coastal Migratory Pelagic Fish" and "South Atlantic Charter / Headboat for Coastal Migratory Pelagic Fish."

Source: Data provided by NMFS, Southeast Region, Sustainable Fisheries Division.

In 2002, a total of about 1.1 million pounds of Coastal Migratory Pelagic FMP-managed species were caught with ALWTRP affected gear (gillnets) in the Southeastern U.S.[17] Top counties for landings of gillnet-caught Coastal Migratory species in the Southeastern U.S. are presented in Exhibit 4-20. As the exhibit shows, Dare County, North Carolina, reported the highest landings, approximately 37 percent of the total.

Exhibit 4-20

GILLNET LANDINGS FOR THE SOUTHEAST COASTAL PELAGIC FISHERY BY COUNTY, FY2002

County	State	Total Pounds Landed
Dare	NC	403,822
Brevard	FL	299,702
St. Lucie	FL	214,529
Monroe	FL	71,986
Indian River	FL	47,316
Other		51,885
TOTAL		1,089,239

Note:

[1] Only fish caught with ALWTRP Affected gear types are included in this summary.

[2] Counties are listed in descending order based on total landings. The top five ports are presented in this exhibit.

Source: Dealer data provided by NMFS, Southeast Region, Sustainable Fisheries Division.

[17] Based on analysis of landings data provided by the NMFS Southeast Regional Office. Figures include landings of Spanish mackerel, king mackerel, cero mackerel, cobia, little tunny, and dolphin-fish.

4.2.7 Black Sea Bass

Black sea bass, *Centropristris striata*, occur in coastal waters from the Gulf of Maine to the Florida Keys, but are more commonly found from Cape Cod, MA to Cape Canaveral, FL. Two distinct populations (northern and southern Atlantic) are thought to exist, with overlapping ranges; hence, they are managed separately (NMFS, 2003c). However, current genetic research indicates that there is mixing between the two populations and they may indeed be one stock (South Atlantic Fishery Management Council, 2003).

Most black sea bass begin life as females and later transform into males, and most individuals (both sexes) attain sexual maturity by age three. Transformation from female to male generally occurs between ages two and five. Females are rarely found older than eight years (>35 cm), while males may live up to 15 years (>60 cm.) Black sea bass are omnivorous and generally feed on crustaceans, mollusks, echinoderms, fish, and plants.[18]

The discussion below provides a brief overview of the northern and southern black sea bass fisheries.

4.2.7.1 Northern Fishery

The northern portion of the black sea bass fishery, which extends from Cape Hatteras to the U.S./Canada border, is managed under the Summer Flounder, Scup, and Black Sea Bass FMP. Because the fishery occurs in both state and Federal waters, the Mid-Atlantic Fishery Management Council (MAFMC) and the Atlantic States Marine Fisheries Commission (ASMFC) jointly developed the FMP.[19] Amendment 13 to this FMP provided the most recent management changes for the black sea bass fishery. Amendment 13 established an annual (calendar year) coast-wide catch quota for the commercial black sea bass fishery to replace the quarterly quota allocation system, and allows vessels to retain their Northeast Region Black Sea Bass Permit during a Federal fishery closure.

Current management measures under the FMP include mandatory vessel trip reporting and gear restrictions. The owner of a vessel issued a black sea bass moratorium permit must mark all traps/pots with the vessel's USCG number or state registration number. Traps/pots must also have an escape vent compliant with the options listed in 50 CFR 648.144 (b)(2), as well as a ghost panel affixed to the trap/pot with degradable fasteners and hinges (50 CFR 648.144(a)).[20] There is no tagging program for this gear and no trap/pot limit.

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[18] Status of Fisheries Resources off Northeastern United States-Black Sea Bass, viewed on http://www.nefsc.noaa.gov/sos/spsyn/og/seabass/ on 8/14/03.

[19] Black sea bass fished south of Cape Hatteras, NC are managed by the South Atlantic Fishery Management Council under the Snapper/Grouper FMP.

[20] Additional gear restrictions apply to otter trawl gear.

The commercial fishery has limited-access restrictions. In the 2002 fishing year, 1,532 vessels held permits for this fishery (938 vessels held commercial moratorium permits; 667 vessels held charter party permits). Exhibit 4-21 presents the number of vessels permitted to fish for black sea bass in the Northeast in FY2002, organized by intended gear. The most prevalent primary gear type is "other gear" – which includes hand lines, rod and reel, harpoons, diving gear, and other unspecified gear types – followed by bottom trawls and traps/pots. A total of 265 vessels (about 17 percent) holding black sea bass permits in the Northeast in FY2002 indicated an ALWTRP affected gear type as their primary gear.

Exhibit 4-21

PERMITTED NORTHERN BLACK SEA BASS VESSELS, FY2002 [1]

	By All Gear		By Primary Gear	
Gear Name	**Number**	**% of Total**	**Number**	**% of Total**
Purse Seine	2	0.1%	1	0.1%
Beach Seine	1	0.1%	0	0.0%
Boat Seine	2	0.1%	0	0.0%
Bottom Trawls	517	33.7%	471	30.7%
Mid-Water Trawls	117	7.6%	8	0.5%
Other Trawls	113	7.4%	7	0.5%
Dredge	35	2.3%	9	0.6%
Gill/Entangling Nets[2]	148	9.7%	48	3.1%
Pots and Traps[2]	330	21.5%	217	14.2%
Longlines and Setlines	91	5.9%	8	0.5%
Other Gear [3]	960	62.7%	777	50.7%
ALL GEAR TYPES [4]	1,532	100.0%	1,532	100.0%

Notes:
1 Permits are issued by fishing year (FY). FY 2002 extended from May 1, 2002 to April 30, 2003.
2 Shading indicates that ALWTRP regulated gear was identified as the primary gear.
3 Includes hand lines, rod and reel, harpoons, diving gear, and other gear types.
4 Number of vessels for each gear type will not sum to number of vessels for "all gear types" because vessels may be permitted to fish using multiple gear types.

Source: Data provided by NMFS, Northeast Region, Fisheries Statistics Office.

Landings of black sea bass in the Northeastern U.S. totaled 3.3 million pounds in 2002. Fish traps/pots and otter trawls were used to catch the greatest percentage of black sea bass, about 42 percent and 40 percent respectively (see Exhibit 4-22). ALWTRP affected gear accounted for 44 percent (1.4 million pounds) of total landings.

The ex-vessel value of northern black sea bass landings in the Northeast totaled $5.6 million in 2002. Fish caught with ALWTRP affected gear types accounted for 42 percent of these revenues. Exhibit 4-23 summarizes the top grossing ports for black sea bass in 2002. As shown, Mid-Atlantic ports predominate, with Virginia Beach/Lynnhaven the most significant both overall and for landings associated with ALWTRP affected gear.

Exhibit 4-22

NORTHERN BLACK SEA BASS LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Pots and Traps[1]	1,378,852	41.67%
Otter Trawl	1,317,370	39.81%
Handline	399,941	12.09%
Unknown	103,462	3.13%
Offshore Lobster Pots and Traps	30,666	0.93%
Other	78,476	2.37%
TOTAL	3,308,767	100.00%

Note:
[1] The general Northeast gear code 18, Pots and Traps, includes, but is not limited to, trap and pot gear targeting fish, eel, conch, hagfish, and other/unclassified species. Traps and pots targeting lobster, shrimp, or crab are included in other general gear categories.

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

Exhibit 4-23

VALUE OF NORTHERN BLACK SEA BASS LANDINGS BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings ($)	Total Value of Fish Caught with ALWTRP Affected Gear[2] ($)	Percent of Revenues Attributable to ALWTRP Affected Gear
Virginia Beach/ Lynnhaven	City of Virginia Beach	VA	903,665	467,646	51.75%
Cape May	Cape May	NJ	468,595	7,543	1.61%
Point Judith	Washington	RI	399,301	60,743	15.21%
Montauk	Suffolk	NY	379,386	32,270	8.51%
Ocean City	Worcester	MD	354,051	272,343	76.92%
Other Ports			3,127,593	1,548,787	49.52%
TOTAL			5,632,591	2,389,332	42.42%

Notes:
[1] Ports are listed in descending order based on the value of landings. The top five ports are presented in this exhibit.
[2] Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.7.2 Southern Fishery[21]

The southern portion of the black sea bass fishery, which extends from Cape Hatteras, NC to Cape Canaveral, FL, is managed under the South Atlantic Fishery Management Council's (SAFMC) Snapper-Grouper Fishery Management Plan. Amendment 8 of this FMP established a limited-entry system for the snapper-grouper fishery. Under this system, individuals who wish to obtain a snapper-grouper permit must buy two transferable vessel permits, one of which is then retired, thus reducing participation in the fishery and pressure on the resource. These regulations were implemented July 16, 1998.[22]

While black sea bass pots are allowed throughout the EEZ north of Cape Canaveral, Florida (except in special management zones), the majority of the pot fishery is concentrated off North Carolina and northern South Carolina.[23] Pots must include a panel or door with an opening equal to or larger than the interior end of the pot's funnel, and the hinges and fasteners of each panel or door must be made of a degradable material. Currently, vessels that hold permits for the snapper/grouper complex have open access to the pot fishery. However, the most recent stock assessment for black sea bass reported a decline in the stock and indicated that in order to rebuild the population within the designated rebuilding timeframe, a reduction in fishing effort is needed. Presently, the Council is considering various measures to address this issue. As a preliminary step, the SAFMC has established a control date of April 23, 1997 for this fishery. If the Council decides to limit access to this fishery in the future, fishermen entering the fishery after the control date risk the chance of losing access.

Commercial vessel permits are issued in the southeast for the South Atlantic snapper-grouper fishery, which includes black sea bass. During the 2002 calendar year, 1,519 vessels were permitted for the snapper/grouper complex. Exhibit 4-24 summarizes the number of permitted vessels, by permit type.

[21] The information in this section is taken from the SAFMC Summary of the Trap/Pot Fisheries Currently Managed by the SAFMC, distributed at the ALWTRT Meeting held April 28-30, 2003, in Warwick, Rhode Island.

[22] M. Murphy, pers. comm., 2003.

[23] Pot fishing has been uncommon off Georgia or northern Florida in recent years.

Exhibit 4-24

VESSELS POSSESSING SNAPPER/GROUPER COMPLEX PERMITS IN 2002, BY PERMIT TYPE

Permit Type	Number of Vessels [1]
Charter Vessels	1,006
Unlimited Commercial (not including sea bass pots) [2]	486
Unlimited Commercial (including sea bass pots) [2]	90
225 lbs. Trip Limit (not including sea bass pots) [2]	136
225 lbs. Trip Limit (including sea bass pots) [2]	9

Notes:
[1] Individual vessels may hold multiple permit types within the snapper/grouper fishery. During the 2002 calendar year, a total of 1,519 vessels obtained one or more snapper/grouper permits.
[2] Includes both standard and transferable permits.

Source: Data provided by NMFS, Southeast Region, Sustainable Fisheries Division.

In the Southern black sea bass fishery, fishermen are required to purchase a tag for each pot they possess. The number of pot tags held gives a rough indication of fishing effort. As shown in Exhibit 4-25, fishermen currently hold over 3,700 black sea bass pot tags. However, it should be noted that most fishermen tend to fish only a portion of their pots while keeping the remaining pots available to replace any losses during the season; the number of tags purchased is often not an entirely accurate count of how many pots are actively fished.

Exhibit 4-25

ACTIVE BLACK SEA BASS POT TAGS IN SOUTHEAST (as of October, 2003)

State	Number of Tags
Florida	130
Georgia	45
South Carolina	920
North Carolina	2,625

Source: Data provided by NMFS, Southeast Regional Office, Sustainable Fisheries Division.

Approximately 400,000 pounds of black sea bass were caught with ALWTRP affected gear (pots) in the Southeastern U.S. in 2002. Landings in Onslow County, NC accounted for 38 percent of this total (see Exhibit 4-26).

Exhibit 4-26

SOUTHEAST POT-CAUGHT BLACK SEA BASS LANDINGS BY COUNTY, FY2002

County	State	Total Pounds Landed
Onslow	NC	153,704
Carteret	NC	83,701
New Hanover	NC	57,596
Brunswick	NC	56,863
Horry	SC	30,499
Other		19,297
TOTAL		401,659

Notes:
1 Only black sea bass caught with ALWTRP affected gear are included in this summary.
2 Counties are listed in descending order based on total landings. The top five counties are presented in this exhibit.

Source: Dealer data provided by NMFS, Southeast Region, Sustainable Fisheries Division.

4.2.8 Hagfish

The Atlantic hagfish, *Myxinidae glutinosa,* is found along the Northeast coast from Newfoundland to North Carolina. Hagfish generally inhabit areas of soft bottom mud and prefer the cool temperatures found in deep water. They have a long eel-like form and can reach a maximum size of between one and a half and two feet. Hagfish are commonly referred to as "slime eels" or "slime hags" because of their ability to secrete copious amounts of slime from a series of mucous sacs on either side of their abdomen (NMFS, 1996).

The hagfish fishery developed out of a need to find other marketable species in areas where traditional commercial stocks have declined. A 1996 report submitted to NMFS examined the potential for establishing a hagfish fishery in the Northeastern U.S. and concluded that adequate demand exists. This demand comes largely from Korea, where the eelskin is tanned into leather and the meat is used as a food source. Traditionally, the fish are exported whole and all processing takes place in Korea.

Currently, the Atlantic hagfish fishery is not regulated, but NMFS and the New England Fishery Management Council are moving toward developing a management scheme for the fishery. In April 2002, the Northeast Region Coordinating Council placed the review of a hagfish assessment on the agenda for the 37th Stock Assessment Review Committee (SARC) workshop.[24] On August 28, 2002 NMFS issued a Notice of Proposed Rulemaking that established a control date for potential future use in determining historical or traditional participation in the fishery.[25] In this notice, NMFS also stated its intent to encourage the New

[24] The SARC was tasked with determining stock size and abundance and estimating biological reference points. It met on June 4, 2003, and developed a set of research needs for the future; the final report on this meeting is forthcoming.

[25] The notice also served to deny the rulemaking requested in a Petition for Rulemaking asking NMFS to implement emergency measures to limit entry into the fishery, as emergency action was deemed unnecessary.

England Fishery Management Council to develop an FMP for the fishery, preventing overcapitalization and increased pressure on the stock due to a movement of vessels into the fishery. This action was motivated, in part, because scientific studies suggest that Atlantic hagfish are likely vulnerable to overfishing due to the low reproductive capacity of the species (67 FR 55191). In November 2002, the NEFMC considered development of an Atlantic hagfish FMP in its discussion of priorities for 2003, but voted not to include it at the time. The topic will be revisited in the 2004 meeting that will determine 2005 priorities.

Landings of hagfish in the Northeastern U.S. totaled 3 million pounds in 2002.[26] Nearly all hagfish were caught with fish pots, gear that may be affected by revisions to the ALWTRP. Exhibit 4-27 summarizes landings by the type of gear used.

Exhibit 4-27

NORTHERN HAGFISH LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Pots and Traps[1]	2,999,949	99.89%
Otter Trawl	3,255	0.11%
Fixed or Stake/Set Gillnet	25	<0.01%
TOTAL	3,003,229	100.00%

Note:
[1] The general Northeast gear code 18, Pots and Traps, includes, but is not limited to, trap and pot gear targeting fish, eel, conch, hagfish, and other/unclassified species. Traps and pots targeting lobster, shrimp, or crab are included in other general gear categories.

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

The ex-vessel value of hagfish landings in the Northeast totaled approximately $1 million in 2002. Virtually all of these revenues were recorded in the port of Gloucester, Massachusetts (see Exhibit 4-28).

[26] Because hagfish is not traditionally considered a target species, reporting of hagfish landings is not required. Thus, landings reported are likely an underestimate of actual landings.

Exhibit 4-28

VALUE OF HAGFISH LANDINGS BY PORT, FY2002

Port	County	State	Total Value of all Landings	Total Value of Fish Caught with ALWTRP Affected Gear[1]	Percent of Revenues Attributable to ALWTRP Affected Gear
Gloucester	Essex	MA	$1,059,066	$1,059,066	100.00%
Newport	Newport	RI	$486	$ -	NA
Point Judith	Washington	RI	$6	$ -	NA
Little Compton	Newport	RI	$4	$4	100.00%
TOTAL			$1,059,562	$1,059,070	99.95%

Notes:
[1] Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.9 Red Crab

Deep-sea Red Crab, *Chaceon quinquedens*, are distributed along the continental shelf edge and slope of the western Atlantic from Emerald Bank, Nova Scotia to the Gulf of Mexico. They are typically found at depths of 200 to 1,800 meters (700-5,900 feet), reach a maximum carapace width of 180 mm, and may live 15 years or more (Serchuk and Wigley, 1982).[27] Scientific research suggests that red crabs are most likely opportunistic omnivores due to the limited availability of food at the depths common for this species. The red crab fishery was previously limited by the high catch-related mortality of the crabs (and rapid degradation of the meat) and a lack of economical processing. Technological advances have made fishing for this species feasible and fresh and frozen meat from the crab is now sold commercially (NEFMC, 2002).

Vessels operating in the red crab fishery typically make 28 to 35 trips per year, with each trip lasting seven to ten days. Trips are limited in duration primarily by the hold capacity of the vessel and the need to keep the product fresh and alive. Vessels fish 500 to 600 traps/pots using 90 to 120 traps/pots per trawl. Traps/pots are allowed to soak 18 to 36 hours, with an average soaking time of 22.5 hours. The reported average trap/pot loss is just over 10 pots/traps per trip (NEFMC, 2002).

Management of the red crab fishery under the Magnuson-Stevens Act occurred relatively recently. Following a request from the New England Fishery Management Council (NEFMC), the Secretary of Commerce issued an emergency rule effective May 18, 2001 for management of the red crab fishery in the Exclusive Economic Zone (EEZ) from 35°15.3' North Latitude (the latitude of Cape Hatteras Light, NC) northward to the U.S./Canada border. An FMP was subsequently developed by the NEFMC, approved by NMFS and implemented by regulations

[27] Serchuk and Wigley (1982) suggest that precise information on life-span and growth rate for red crabs is lacking.

effective October 20, 2002 (NEFMC, 2002). The regulations include measures to limit and control effort in the fishery, including a limited-access permit system. Specifically, access to the fishery is limited to those fishermen who met specific criteria during a qualifying period; no additional entrants are allowed, but permits may be sold or otherwise transferred to a new owner. The regulations include gear restrictions and days-at-sea (DAS) allocations. Other measures include gear marking requirements, mandatory vessel trip reports, and a requirement for operator permits and dealer permits (NMFS, 2002a).

Of the 879 vessels permitted to fish for red crab in FY2002, 874 vessels had incidental bycatch permits and five had controlled access permits. Exhibit 4-29 presents a count of vessels permitted to fish for red crab by all intended gear types, and by primary gear type, within the red crab management unit. Traps/pots are the most prevalent primary gear, followed closely by bottom trawls, then dredges. In all, 411 vessels (46.8 percent) holding red crab permits in FY2002 indicated an ALWTRP affected gear type as the primary gear. It is noteworthy that virtually all of the red crab sold commercially in 2002 was landed by the five vessels with controlled access permits; these vessels use trap/pot gear potentially subject to ALWTRP regulations.

Exhibit 4-29

NORTHEAST PERMITTED RED CRAB VESSELS, FY2002 [1]

	By All Gear		By Primary Gear	
Gear Name	**Number**	**% of Total**	**Number**	**% of Total**
Purse Seine	3	0.3%	1	0.1%
Beach Seine	2	0.2%	0	0.0%
Boat Seine	3	0.3%	0	0.0%
Bottom Trawls	380	43.2%	329	37.4%
Mid-Water Trawls	30	3.4%	2	0.2%
Other Trawls	44	5.0%	11	1.3%
Dredge	156	17.7%	101	11.5%
Gill/Entangling Nets[2]	79	9.0%	29	3.3%
Pots and Traps[2]	477	54.3%	382	43.5%
Longlines and Setlines	15	1.7%	4	0.5%
Other Gear [3]	53	6.0%	29	3.3%
ALL GEAR TYPES [4]	879	100.0%	879	100.0%

Notes:

[1] Permits are issued by fishing year (FY). FY 2002 extended from March 1, 2002 to February 28/29, 2003.

[2] Shading indicates that ALWTRP regulated gear was identified as the primary gear.

[3] Includes hand lines, rod and reel, harpoons, diving gear, and other gear types.

[4] Number of vessels for each gear type will not sum to number of vessels for "all gear types" because vessels may be permitted to fish using multiple gear types.

Source: Data provided by NMFS, Northeast Region, Fisheries Statistics Office.

About 4.8 million pounds of red crab were landed in the Northeastern U.S. in 2002. Almost all of the red crab landed was caught using crab pots/traps potentially subject to ALWTRP gear modification requirements (see Exhibit 4-30).

Exhibit 4-30

RED CRAB LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Crab Pots and Traps	4,780,991	99.99%
Offshore Lobster Pots and Traps	428	0.01%
Unknown	133	<0.01%
TOTAL	4,781,552	100.00%

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

The ex-vessel value of red crab landings in the Northeast totaled roughly $4 million in 2002. Virtually all of this revenue came from crab landed with ALWTRP affected gear. Exhibit 4-31 summarizes the top grossing ports for red crab in 2002. As shown, two Massachusetts ports – New Bedford and Fall River – account for the majority of red crab revenues.

Exhibit 4-31

VALUE OF RED CRAB LANDINGS BY PORT, FY2002

Port	County	State	Total Value of all Landings ($)	Total Value of Landings with ALWTRP Affected Gear[1] ($)	Percent of Revenues Attributable to ALWTRP Affected Gear
New Bedford	Bristol	MA	1,948,522	1,948,522	100.00%
Fall River	Bristol	MA	1,097,342	1,097,342	100.00%
Melville	Newport	RI	768,194	768,194	100.00%
Scituate	Plymouth	MA	95,890	95,890	100.00%
Tiverton	Newport	RI	52,080	52,080	100.00%
Other Ports			80,467	80,415	99.94%
TOTAL			4,042,495	4,042,443	100.00%

Notes:

[1] Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.10 Scup

Scup, *Stenotomus chrysops*, occur primarily in the Mid-Atlantic Bight from Cape Cod, MA to Cape Hatteras, NC. Seasonal migrations occur during spring and autumn. In summer, scup are common in inshore waters from Massachusetts to Virginia, while in winter, scup are found in offshore waters between Hudson Canyon and Cape Hatteras at depths ranging from 70 to 180 meters (38 to 98 fathoms). Sexual maturity is essentially complete by age three at a total

length of 21 centimeters (8.3 inches), and spawning occurs during summer months. Scup attain a maximum fork length of about 40 centimeters (16 inches), and ages of up to 20 years have been reported. Tagging studies have indicated the possibility of two stocks, one in southern New England waters and the other extending south from New Jersey. However, because the separation of stocks is not well-defined spatially, they are not considered distinct (NMFS, 2003b).

The fishery is now managed under the Mid-Atlantic Fishery Management Council's Summer Flounder, Scup, and Black Sea Bass FMP. Management within the commercial fishery includes a moratorium on commercial permits. Under this moratorium, only a limited number of permits are granted each year. Additional regulations include annually adjustable commercial trawl mesh and minimum size restrictions, and commercial catch quotas for the fishing year (January 1-December 31) (Mid-Atlantic Fishery Management Council, 2003). The scup season is divided into three periods: Winter I, Summer, and Winter II. The fishery is closed each period once the quota for the season has been reached.

In 2002, NMFS issued commercial moratorium permits for scup to 866 vessels and charter/party permits to 617 vessels. Both the commercial moratorium and charter/party permits have mandatory reporting requirements and are included in the Vessel Trip Reporting system. Exhibit 4-32 presents the number of vessels permitted to fish for scup in the Northeast under the authority of the Summer Flounder, Scup, and Black Sea Bass FMP, by intended gear type and intended primary gear type. The most prevalent primary gear type is "other gear" – which includes hand lines, rod and reel, harpoons, diving gear, and other unspecified gear types – followed by bottom trawls. A total of 157 vessels (11.0 percent) holding scup permits in FY2002 indicated an ALWTRP affected gear type as their primary gear.

Scup landings in the Northeastern U.S. totaled approximately 7.3 million pounds in 2002. Otter trawls and handlines were used to catch the greatest percentage of scup, about 66 percent and 14 percent, respectively (see Exhibit 4-33). Of the total landings, about 531,000 pounds (seven percent) were caught using ALWTRP affected gear (traps/pots).

The ex-vessel value of scup landings in the Northeast totaled $4.8 million in 2002. Of these revenues, 11 percent came from fish caught with ALWTRP affected gear. Exhibit 4-34 summarizes the top grossing ports for scup in 2002. As shown, Point Judith, Rhode Island, is the leading port, although significant quantities of scup are also landed at other locations.

Exhibit 4-32

PERMITTED SCUP VESSELS, FY2002 [1]

Gear Name	By All Gear		By Primary Gear	
	Number	% of Total	Number	% of Total
Purse Seine	1	0.1%	0	0.0%
Beach Seine	0	0.0%	0	0.0%
Boat Seine	2	0.1%	0	0.0%
Bottom Trawls	592	41.5%	549	38.5%
Mid-Water Trawls	139	9.7%	5	0.4%
Other Trawls	125	8.8%	6	0.4%
Dredge	29	2.0%	11	0.8%
Gill/Entangling Nets[2]	156	10.9%	50	3.5%
Pots and Traps[2]	163	11.4%	107	7.5%
Longlines and Setlines	88	6.2%	7	0.5%
Other Gear [3]	833	58.4%	695	48.7%
ALL GEAR TYPES [4]	1426	100.0%	1426	100.0%

Notes:

[1] Permits are issued by fishing year (FY). FY 2002 extended from May 1, 2002 to April 30, 2003.

[2] Shading indicates that ALWTRP regulated gear was identified as the primary gear.

[3] Includes hand lines, rod and reel, harpoons, diving gear, and other gear types.

[4] Number of vessels for each gear type will not sum to number of vessels for "all gear types" because vessels may be permitted to fish using multiple gear types.

Source: Data provided by NMFS, Northeast Region, Fisheries Statistics Office.

Exhibit 4-33

SCUP LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Otter Trawl	4,818,928	66.26%
Handline	1,000,445	13.76%
Pots and Traps[1]	531,147	7.30%
Floating Trap	485,696	6.68%
Pound Net	209,721	2.88%
Other	226,651	3.12%
TOTAL	7,272,588	100.00%

Note:

[1] The general Northeast gear code 18, Pots and Traps, includes, but is not limited to, trap and pot gear targeting fish, eel, conch, hagfish, and other/unclassified species. Traps and pots targeting lobster, shrimp, or crab are included in other general gear categories.

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

Exhibit 4-34

VALUE OF SCUP LANDINGS BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings ($)	Total Value of Fish Caught with ALWTRP Affected Gear[2] ($)	Percent of Revenues Attributable to ALWTRP Affected Gear
Point Judith	Washington	RI	1,250,739	179,940	14.39%
Montauk	Suffolk	NY	532,364	3,616	0.68%
Pt. Pleasant	Ocean	NJ	347,705	451	0.13%
Newport	Newport	RI	319,906	37,086	11.59%
Hampton Bay	Suffolk	NY	317,195	1,749	0.55%
Other Ports			2,041,318	327,725	16.05%
TOTAL			4,809,227	550,567	11.45%

Notes:

1 Ports are listed in descending order based on the value of landings. The top five ports are presented in this exhibit.

2 Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.11 Jonah Crab

Jonah crab, *Cancer borealis*, is currently an unregulated species in Federal waters. Little is known about the species' biology, distribution, and relative abundance. Also known as the Rock crab and the Bull crab, Jonah crabs are found from Florida to Nova Scotia, mainly in offshore, rocky habitats. Females obtain a carapace width of 100 mm after about eight years, and males reach 130 mm in six to seven years. Individuals larger than 190 mm have not been observed, and it is believed that a terminal molt size might exist (NMFS, 2002b).

Jonah crab is a traditional by-catch of the Maine lobster fishery. Jonah crab landings have traditionally been used by lobstermen as a supplement to cover operating expenses. However, due to a recent increase in crab abundance and market demand, it has become profitable for lobstermen to target Jonah crab with lobster traps/pots during times of low lobster landings (generally in the spring). This in turn has led to interest in targeting Jonah crabs year round.

The State of Maine Department of Marine Resource (DMR) applied for an Exempted Fishing Permit that would allow lobstermen to fish experimental Jonah crab traps/pots in addition to their allotment of lobster traps/pots. This request triggered a Section 7 consultation that found that the proposed exemption would result in jeopardy to right whales. As a result, the action and consulting agencies developed an RPA and in September 2003, the Maine Department of Marine Resources (DMR) was granted a one-year Exempted Fishing Permit. This permit allowed 100 participating fishermen to fish their permitted allotment of lobster traps/pots (in state and/or Federal waters) plus 200 experimental Jonah crab traps/pots in Federal waters of

Federal Lobster Management Area 1.[28] Through this process, DMR hopes to demonstrate that the experimental Jonah crab trap/pot targets crabs, rather than lobster. If proven, DMR hopes to encourage NMFS and the ASMFC to revise the lobster regulations such that these modified traps/pots would not be considered lobster traps/pots and, consequently, would not be counted toward the fishermen's total allotment of traps/pots under the lobster regulations. The DMR expects that this study could lead to further examination of the potential sustainability and practicality of a directed Jonah crab fishery in the area.[29]

Landings of Jonah crab in the Northeastern U.S. totaled 2.6 million pounds in 2002.[30] Offshore and inshore lobster traps/pots were used to catch the greatest percentage of Jonah crab, 86 percent and 13 percent, respectively (see Exhibit 4-35). Nearly all of the landings were accounted for by ALWTRP affected gear.

Exhibit 4-35

JONAH CRAB LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Offshore Lobster Pots and Traps	2,260,383	86.09%
Inshore Lobster Pots and Traps	335,749	12.79%
Fixed or Stake/Set Gillnet	17,316	0.66%
Crab Pots and Traps	5,898	0.22%
Pots and Traps[1]	2,996	0.11%
Other	3,182	0.12%
TOTAL	2,625,524	100.00%

Note:
[1] The general Northeast gear code 18, Pots and Traps, includes, but is not limited to, trap and pot gear targeting fish, eel, conch, hagfish, and other/unclassified species. Traps and pots targeting lobster, shrimp, or crab are included in other general gear categories.

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

The ex-vessel value of Jonah crab landings in the Northeast totaled $1.5 million in 2002. Exhibit 4-36 identifies the top grossing ports. As shown, two ports account for the majority of revenues: Sandwich, Massachusetts and Newington, New Hampshire.

[28] This permit was also granted for the previous fishing year.

[29] C. Wilson, pers. comm., 2003.

[30] Data on Jonah crab landings may be inaccurate due to frequent misidentification at the docks as well as substantial cash transactions that are never documented.

Exhibit 4-36

VALUE OF JONAH CRAB LANDINGS BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings ($)	Total Value of Landings with ALWTRP Affected Gear[2] ($)	Percent of Revenues Attributable to ALWTRP Affected Gear
Sandwich	Barnstable	MA	779,764	779,764	100.00%
Newington	Rockingham	NH	308,915	308,915	100.00%
South Bristol	Lincoln	ME	88,779	88,779	100.00%
Newport	Newport	RI	62,366	62,366	100.00%
Gloucester	Essex	MA	58,648	58,460	99.68%
Other Ports			223,062	222,173	99.60%
TOTAL			1,521,534	1,520,457	99.93%

Notes:

1 Ports are listed in descending order based on the value of landings. The top five ports are presented in this exhibit.

2 Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.12 Conch and Whelk[31]

The Atlantic Coast whelk fishery targets two principal species, the knobbed whelk (*Busycon carica*) and the channeled whelk (*Busycon canaliculatum*).[32] Both species are found in temperate waters from Massachusetts to Florida. They range from seven to ten inches in length.

The commercial whelk pot fishery along the Atlantic coast runs from Massachusetts to the Carolinas. Whelk meat is sold for consumption in both the domestic and international (primarily Asian) markets; however, recent data suggest that the majority of whelk meat is used as bait in the horseshoe crab fishery.

Approximately 6.3 million pounds of whelk were landed in the Northeast U.S. in 2002. Whelk is primarily caught by potting or trawling/dredging, and these methods accounted for 54 percent and 30 percent of the landings, respectively. Exhibit 4-37 illustrates the distribution of landings by gear type.

[31] Information in this section is taken from U.S. Fish and Wildlife Service, 2000.

[32] The knobbed and channeled whelk caught along the Atlantic coast are commonly referred to as "conch" in industry transactions.

Exhibit 4-37

CONCH/WHELK LANDINGS BY GEAR TYPE, FY2002

Gear Type	Total Pounds Landed	Percent of Total Pounds Landed
Pots and Traps[1]	3,438,839	54.39%
Scrapes/Dredges	1,869,530	29.57%
Unknown	360,784	5.71%
Otter Trawl	287,435	4.55%
Crab Pots and Traps	268,348	4.24%
Other	97,443	1.54%
TOTAL	6,322,379	100.00%

Note:
[1] The general Northeast gear code 18, Pots and Traps, includes, but is not limited to, trap and pot gear targeting fish, eel, hagfish, and other/unclassified species. Traps and pots targeting lobster, shrimp, or crab are included in other general gear categories.

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

The ex-vessel value of whelk landings in the Northeast totaled approximately $3.3 million in 2002. Exhibit 4-38 summarizes the top grossing ports for whelk in 2002. Landings are distributed among a variety of ports, with Dukes County (Massachusetts) and Newport News (Virginia) most prominent.

Exhibit 4-38

VALUE OF WHELK LANDINGS BY PORT, FY2002[1]

Port	County	State	Total Value of all Landings ($)	Total Value of Landings with ALWTRP Affected Gear[2] ($)	Percent of Revenues Attributable to ALWTRP Affected Gear
Other Ports in Dukes County	Dukes	MA	596,466	581,623	97.51%
Newport News	City of Newport News	VA	511,822	511,217	99.88%
Wachapreague	Accomac	VA	302,605	283,045	93.54%
Mispillion	Kent	DE	215,660	141,728	65.72%
Other Ports in Cape May County	Cape May	NJ	207,563	10,154	4.89%
Other Ports			1,492,348	897,454	60.14%
TOTAL			3,326,464	2,425,221	72.91%

Notes:
[1] Ports are listed in descending order based on the value of landings. The top five ports are presented in this exhibit.
[2] Includes fixed gillnets (NEGEAR2=10), drift gillnets (11), mixed traps/pots (18), shrimp trap/pots (19), offshore lobster trap/pot (20), inshore lobster trap/pot (21), and crab trap/pots (30).

Source: Dealer data provided by NMFS, Northeast Region, Fisheries Statistics Office.

4.2.13 Other Affected Fisheries

The gear modifications required by the ALWTRP will affect all fisheries that use gillnets or traps/pots. The previous sections discuss fisheries that rely heavily on such gear and thus are most likely to be affected by changes in ALWTRP requirements. Other trap/pot fisheries that may be affected to a lesser extent by changes in ALWTRP regulations include the fisheries for Northern shrimp (Maine), blue crab, rock crab, catfish, tautog, cod, haddock, pollock, redfish, white hake, and American eel. Some of these trap/pot fisheries are small and primarily recreational (e.g., tautog). Others are commercially significant, but either make limited use of affected trap/pot gear (e.g., Northern shrimp, cod) or occur primarily in coastal or estuarine waters not covered by the ALWTRP (e.g., blue crab, American eel). As noted, Appendix 4-A provides a complete listing of the species landed using trap/pot gear. NMFS welcomes comments to help determine if all appropriate directed fisheries have been included in the ALWTRP regulations.

Other potentially affected gillnet fisheries include Atlantic croaker, spot, striped bass, bluefish, skate, and weakfish. Catch of these species by ALWTRP affected gear types is relatively small. However, to the extent that these species are caught with ALWTRP affected gear in ALWTRP regulated areas, and are part of a Category I or II fishery as designated by the List of Fisheries, fishermen may be affected by the ALWTRP.

4.3 OTHER AFFECTED SPECIES

The ALWTRP may also benefit other protected species that inhabit the same waters as Atlantic large whales. Evidence suggests that some of these species can become entangled in fishing gear; therefore, this risk may be affected by changes in ALWTRP requirements. This section discusses the life cycle and abundance of each species and briefly reviews threats to each species' survival, including interaction with commercial fishing gear. Chapter 5 provides more detailed information on the entanglement risk these species face, and the potential risk reduction offered by the regulatory alternatives under consideration.

The discussion below is divided into two categories: (1) species not likely to be affected by changes in ALWTRP requirements; and (2) species potentially affected by changes in ALWTRP requirements. Exhibit 4-39 summarizes the species of interest and their current status under the ESA or MMPA.

Exhibit 4-39

OTHER SPECIES POTENTIALLY AFFECTED BY ALWTRP MODIFICATIONS

Potential Effect	Category	Species	Status
Not Likely to Be Affected	Fish	Atlantic Salmon	Endangered
		Shortnose Sturgeon	Endangered
	Birds	Piping Plover	Endangered
		Roseate Tern	Endangered
Potentially Affected	Whales	Blue Whale	Endangered
		Sei Whale	Endangered
		Sperm Whale	Endangered
	Porpoises and Dolphins	Harbor Porpoise	Protected
		WNA Coastal Bottlenose Dolphin	Protected
		Atlantic White-Sided Dolphin	Protected
		Risso's Dolphin	Protected
		Spotted Dolphin	Protected
		Striped Dolphin	Protected
		Pilot Whale	Protected
		Offshore Bottlenose Dolphin	Protected
		Common Dolphin	Protected
	Seals	Harbor Seal	Protected
		Gray Seal	Protected
		Harp Seal	Protected
	Turtles	Kemp's Ridley Sea Turtle	Endangered
		Loggerhead Sea Turtle	Threatened
		Leatherback Sea Turtle	Endangered
		Green Sea Turtle	Endangered
		Hawksbill Sea Turtle	Endangered

4.3.1 Species Not Likely to Be Affected

Several endangered or protected species are found in waters regulated under the ALWTRP but are not likely to be entangled in trap/pot or gillnet gear managed by the Plan. These species are discussed briefly below.

4.3.1.1 Atlantic Salmon

At one time, Atlantic salmon (*Salmo salar*) distinct population segments (DPSs) probably existed in Long Island Sound and Central New England.[33] Today, the only remaining U.S. Atlantic salmon DPS is in the Gulf of Maine. The Gulf of Maine DPS includes all coastal watersheds north of, and including tributaries of, the lower Kennebec River (below the former Edwards Dam site) to the mouth of the St. Croix River at the U.S./Canada border. At least eight rivers in the Gulf of Maine DPS range still contain functioning wild Atlantic salmon populations,

[33] The ESA extends protection to a distinct population segment (DPS) in part to preserve genetic diversity important to the species' survival. A DPS is a population segment that is: (1) "discrete" (to some extent separated from the remainder of the species or subspecies), and (2) "significant" (biologically and ecologically).

including Cove Brook and the Dennys, East Machias, Machias, Pleasant, Narraguagus, Ducktrap, and Sheepscot rivers (NMFS and U.S. Fish and Wildlife Service, 2000). The U.S. Fish and Wildlife Service listed the Atlantic salmon in this DPS as endangered on November 17, 2000.

Atlantic salmon spawn in fresh water in the early autumn. The fertilized eggs remain in gravel on the stream bottom until spring, when they hatch and small fish called "fry" emerge. Fry quickly develop into "parr," a two- to three-inch-long fish that remains in freshwater. In New England rivers, it takes parr two to three years to grow large enough to develop into "smolts." In the smolt stage (approximately six inches long), the young salmon migrate downstream to the ocean. Less is known about the animal's saltwater life, but tagging studies have shown that young salmon migrate as far north as the Labrador Sea during their first summer in the ocean. After their first winter at sea, some of the salmon become sexually mature and return to their natal rivers to spawn. These are referred to as "one seawinter salmon" or "grilse," and are much more common among Canadian stocks than among the salmon in Maine rivers. Salmon that remain at sea for a second winter to feed in the coastal waters of Canada and Greenland grow to approximately 30 inches in length and eight to 15 pounds. These salmon can return from the ocean anytime from spring through fall, but the peak "run" is in June. Spawning takes place from late October through November. Some salmon return to sea immediately after spawning, but most (80 percent) spend the winter in the stream and migrate back to the ocean in the spring.

Historically, two seawinter fish were caught in commercial gillnet fisheries off Nova Scotia, Newfoundland, Labrador, and West Greenland. These fisheries have recently been closed or vastly reduced to protect the remaining stocks. There has also been recreational fishing for salmon in rivers and estuaries as they return to spawn. In recent years, this activity was limited to catch-and-release fishing; in 2000, recreational fishing was closed altogether (except for an angling fishery on stocked fish farther south in the Merrimack River) (NMFS and U.S. Fish and Wildlife Service, 2000).

No comprehensive data exist on the current abundance of Atlantic salmon. The Atlantic Salmon Commission and NMFS have conducted population surveys in the Narraguagus River basin. Since 1996, estimates of large parr in the Narraguagus River have ranged from 11,700 to 27,000, while corresponding estimates of outmigrating smolt range from 2,800 to 3,600. These and other data have led researchers to conclude that low overwinter and emigration survival rates may be impeding Atlantic salmon recovery. Overall, naturally reproducing Atlantic salmon populations in the Gulf of Maine DPS are considered to be very low. Experts base this conclusion on the fact that spawner abundance is less than 10 percent of the number required to maximize juvenile production; juvenile abundance indices are lower than historical counts; and freshwater smolt production is less than a third of estimated capacity (65 FR 69459).

No data exist to demonstrate that Atlantic salmon interact with ALWTRP regulated gear. Because the ALWTRP changes will exempt harbors and other near-coastal waters in Maine, changes in the plan will likely have little impact on the survival of Atlantic salmon in the Gulf of Maine.

4.3.1.2 Shortnose Sturgeon

The sturgeon family is among the most primitive of the bony fishes. The shortnose sturgeon (*Acipenser brevirostrum*) shares the same general external morphology of all sturgeon. Its elongated fusiform body is moderately depressed and the body surface contains five rows of bony plates or scutes. Its subterminal mouth has barbels and is well suited for bottom feeding (mollusks and crustaceans are the primary food of adults) and a generally benthic existence.

The shortnose sturgeon is an anadromous fish that spawns in the coastal rivers along the east coast of North America from the St. John River in Canada to the St. Johns River in Florida. It prefers the nearshore marine, estuarine, and riverine habitat of large river systems. Unlike other anadromous species in the region such as shad or salmon, shortnose sturgeon do not appear to make long-distance offshore migrations. Hence, the impact of the ALWTRP on the species is likely to be minor.[34]

Male and female shortnose sturgeons mature at the same length (45 to 55 cm fork length) throughout their range. However, age of maturation varies from north to south due to a slower growth rate in the north. Males may mature at two to three years of age in Georgia, at age three to five from South Carolina to New York, and at age 10 to 11 in the St. John River, Canada. Females exhibit a similar trend and mature at age six or younger in Georgia, at age six to seven from South Carolina to New York, and at age 13 in the St. John River. Age of first spawning in males occurs one to two years after maturity, but among females is delayed for up to five years. Generally, females spawn every three years, although males may spawn every year.

While the shortnose sturgeon was rarely the target of a commercial fishery, it often was taken incidentally in the commercial fishery for Atlantic sturgeon. In the 1950s, sturgeon fisheries declined on the east coast and systematic data on shortnose sturgeon landings became scarce. This led the Fish and Wildlife Service (FWS) to conclude that the fish had been eliminated from the rivers in its historic range (except the Hudson River) and was in danger of extinction. FWS believed the population level of the shortnose sturgeon had declined because of pollution and overfishing, both directly and incidentally in shad gillnets.

The shortnose sturgeon (*Acipenser brevirostrum*) was listed as endangered in its entire range on March 11, 1967 (32 FR 4001). Shortnose sturgeon remained on the endangered species list with enactment of the ESA in 1973. Populations occur in New Brunswick, Canada (1), Maine (2), Massachusetts (1), Connecticut (1), New York (1), New Jersey/Delaware (1), Maryland/Virginia (1), North Carolina (1), South Carolina (4), Georgia (4) and Florida (2).

No data exist to demonstrate that shortnose sturgeon interact with ALWTRP regulated gear; therefore, trap/pot and gillnet gear managed under the ALWTRP pose little or no threat to this species.

[34] Unless otherwise indicated, the information provided in this section is based on material provided at the NMFS Protected Resources website: http://www.nmfs.noaa.gov/prot_res/species/fish/Shortnose_sturgeon.html.

4.3.1.3 Roseate Tern and Piping Plover

The roseate tern (*Sterna dougallii dougallii*) and piping plover (*Charadrius melodus*) inhabit coastal waters and nest on coastal beaches within the Northeast Region. Terns prey on small schooling fishes while plovers prey on shoreline invertebrates and other small fauna. Foraging activity for these species occurs either along the shoreline (plovers) or within the top several meters of the water column (terns). Trap/pot and gillnet gear managed under the ALWTRP are expected to pose little or no threat to these species or their forage species.

4.3.2 Species Potentially Affected

A variety of endangered, threatened, or protected species would potentially be affected by changes in ALWTRP requirements. The sections below examine whale, porpoise, dolphin, seal, turtle, and fish species whose survival may be affected by interactions with commercial fishing gear.

4.3.2.1 Whales

Blue Whale

Like the fin whale, blue whales (*Balaenoptera musculus*) occur worldwide and are believed to follow a similar migration pattern from northern summering grounds to more southern wintering areas (Perry et al., 1999). Three subspecies have been identified: *Balaenoptera musculus musculus, B.m. intermedia*, and *B.m. brevicauda* (NMFS, 1998b). Only *B.m. musculus* occurs in the northern hemisphere. Blue whales range in the North Atlantic from the subtropics to Baffin Bay and the Greenland Sea. The IWC currently recognizes these whales as one stock (Perry et al., 1999).

Blue whales were hunted intensively from the turn of the century, when development of steam-powered vessels and deck-mounted harpoon guns made it possible to exploit them on an industrial scale, to the mid-1960s (NMFS, 1998b). Blue whale populations declined worldwide as the new technology spread and became widely used (Perry et al., 1999). Subsequently, the whaling industry shifted effort away from declining blue whale stocks and targeted other large species, such as fin whales, and then resumed hunting for blue whales when the species seemed to be more abundant (Perry et al., 1999). The result was a cyclical rise and fall, leading to severe depletion of blue whale stocks worldwide (Perry et al., 1999). In all, at least 11,000 blue whales were taken in the North Atlantic from the late 19th century through the mid-20th century. Blue whales were given complete protection in the North Atlantic in 1955 under the International Convention for the Regulation of Whaling. There are no good estimates of the pre-exploitation size of the western North Atlantic blue whale stock, but it is widely believed that this stock was severely depleted by the time legal protection was introduced in 1955 (Perry et al., 1999). Mitchell (1974) suggested that the stock numbered in the very low hundreds during the late 1960s through early 1970s (Perry et al., 1999). Photo-identification studies of blue whales in the

Gulf of St. Lawrence from 1979 to 1995 identified 320 individual whales (NMFS, 1998b). NMFS recognizes a minimum population estimate of 308 blue whales within the Northeast Region (Waring et al., 2002).

Blue whales are only occasional visitors to east coast U.S. waters. They are more commonly found in Canadian waters, particularly the Gulf of St. Lawrence, where they are present for most of the year, and in other areas of the North Atlantic. It is assumed that blue whale distribution is governed largely by food requirements (NMFS, 1998b). In the Gulf of St. Lawrence, blue whales seem to predominantly feed on a variety of copepod species (NMFS, 1998b).

Compared to the other species of large whales, relatively little is known about this species. Sexual maturity is believed to occur in both sexes between five and 15 years of age. Gestation lasts ten to 12 months and calves nurse for six to seven months. The average calving interval is estimated to be two to three years. Birth and mating both take place in the winter season (NMFS, 1998b), but the location of wintering areas is speculative (Perry et al., 1999). In 1992, the U.S. Navy and contractors conducted an extensive blue whale acoustic survey of the North Atlantic and found concentrations of blue whales on the Grand Banks and west of the British Isles. One whale was tracked for 43 days, during which it traveled 1,400 nautical miles around the general area of Bermuda (Perry et al., 1999).

There is limited information on the factors affecting natural mortality of blue whales in the North Atlantic. Ice entrapment is known to kill and seriously injure some blue whales during late winter and early spring, particularly along the southwest coast of Newfoundland. Habitat degradation has been suggested as possibly affecting blue whales in the Gulf of St. Lawrence, where habitat has been degraded by acoustic and chemical pollution. However, there are no data to confirm that blue whales have been affected by such habitat changes (Perry et al., 1999).

Ship strikes and entanglements in commercial fishing gear are believed to be the major sources of anthropogenic mortality and injury of blue whales. However, confirmed deaths or serious injuries are few. In 1987, concurrent with an unusual influx of blue whales into the Gulf of Maine, one report was received from a whale watch boat that spotted a blue whale in the southern Gulf of Maine entangled in gear described as probable lobster pot gear. A second animal found in the Gulf of St. Lawrence apparently died from the effects of an entanglement. In March 1998, a juvenile male blue whale was carried into Rhode Island waters on the bow of a tanker. The cause of death was determined to be due to a ship strike that may have occurred outside the U.S. EEZ (Waring et al., 2002).

Sei Whale

The range of sei whales (*Balaenoptera borealis*) extends from subpolar to subtropical and even tropical marine waters; however, the species is most commonly found in temperate waters (Perry et al., 1999). Based on past whaling operations, the IWC recognized three stocks in the North Atlantic: (1) Nova Scotia; (2) Iceland-Denmark Strait; and (3) Northeast Atlantic (Donovan, 1991 *in* Perry et al., 1999). Mitchell and Chapman (1977) suggested that the sei

whale population in the western North Atlantic consists of two stocks, a Nova Scotian Shelf stock and a Labrador Sea stock. The Nova Scotian Shelf stock includes the continental shelf waters of the Northeast Region, and extends northeastward to south of Newfoundland. The IWC boundaries for this stock are from the U.S. east coast to Cape Breton, Nova Scotia and east to 42°00'W longitude (Waring et al., 2003). This is the only sei whale stock within ALWTRP boundaries.

Sei whales became the target of modern commercial whalers in the late 19th and early 20th century after stocks of other whales, including right, humpback, fin, and blues, had already been depleted. Sei whales were taken in large numbers by Norway and Scotland from the beginning of modern whaling (NMFS, 1998a). Small numbers were also taken off of Spain, Portugal, and West Greenland from the 1920s to 1950s (Perry et al., 1999). In the western North Atlantic, a total of 825 sei whales were taken on the Scotian Shelf between 1966 and 1972, and an additional 16 were taken by a shore-based Newfoundland whaling station (Perry et al., 1999). The species continued to be exploited in Iceland until 1986 even though measures to stop whaling of sei whales in other areas had been put into place in the 1970s (Perry et al., 1999). There is no estimate for the abundance of sei whales prior to commercial whaling. Based on whaling records, approximately 14,295 sei whales were taken in the entire North Atlantic from 1885 to 1984 (Perry et al., 1999).

Sei whales winter in warm temperate or subtropical waters and summer in more northern latitudes. In the North Atlantic, most births occur in November and December when the whales are on their wintering grounds. Conception is believed to occur in December and January. Gestation lasts for 12 months, and calves are weaned at between six and nine months when the whales are on the summer feeding grounds (NMFS, 1998a). Sei whales reach sexual maturity between five and 15 years of age. The calving interval is believed to be two to three years (Perry et al., 1999).

Sei whales occur in deep water throughout their range, typically over the continental slope or in basins situated between banks (NMFS, 1998a). In the northwest Atlantic, the whales travel along the eastern Canadian coast in autumn on their way to the Gulf of Maine and Georges Bank, where they occur in winter and spring. Within the Northeast Region, the sei whale is most common on Georges Bank, including the Great South Channel, and into the Gulf of Maine/Bay of Fundy region during spring and summer. Individuals may range as far south as North Carolina. It is important to note that sei whales are known for inhabiting an area for weeks at a time, then disappearing for years or even decades. This has been observed in many areas, including in the southwestern Gulf of Maine in 1986, but the basis for this phenomenon is not clear.

Although sei whales may prey upon small schooling fish and squid in the Northeast Region, available information suggests that calanoid copepods are the primary prey of this species. There are occasional influxes of sei whales farther into Gulf of Maine waters, presumably in conjunction with years of high copepod abundance inshore. Sei whales are occasionally seen feeding in association with right whales in the southern Gulf of Maine and in the Bay of Fundy, although there is no evidence of interspecific competition for food resources. There is very little information on natural mortality factors for sei whales. Possible causes of

natural mortality, particularly for young, old, or otherwise compromised individuals, are shark attacks, killer whale attacks, and endoparasitic helminthes (Perry et al., 1999).

There are insufficient data to determine trends of the sei whale population. Because there are no abundance estimates within the last ten years, a minimum population estimate cannot be determined for management purposes (Waring et al., 2003). Abundance surveys are problematic because this species is difficult to distinguish from the fin whale and too little is known of the sei whale's distribution, population structure and patterns of movement.

Few instances of injury or mortality of sei whales due to entanglement or vessel strikes have been recorded in U.S. waters. There was no reported fishery-related mortality or serious injury to sei whales in fisheries observed by NMFS during 1997 through 2001 (Waring et al., 2003). Entanglement is not known to affect this species in the U.S. Atlantic, possibly because sei whales typically inhabit waters farther offshore than most commercial fishing operations, or perhaps because any entanglements that do occur in offshore areas are less likely to be observed. A small number of ship strikes of this species have been recorded, the most recent documented incident occurring in 1994, when a carcass was brought in on the bow of a container ship in Boston, Massachusetts (Waring et al., 2003).

Sperm Whale

Sperm whales (*Physeter macrocephalus*) inhabit all ocean basins, from equatorial waters to the polar regions (Perry et al., 1999). In the western North Atlantic they range from Greenland to the Gulf of Mexico and the Caribbean. The sperm whales that occur in the western North Atlantic are believed to represent only a portion of the total stock (Blaylock et al., 1995). Total numbers of sperm whales off the U.S. or Canadian Atlantic coast are unknown, although eight estimates from selected regions of the habitat do exist for select time periods. The best estimate of abundance for the North Atlantic stock of sperm whales is 4,702 (CV=0.36) (Waring et al., 2002). The IWC recognizes one stock for the entire North Atlantic (Waring et al., 2002).

The IWC estimates that nearly a quarter-million sperm whales were killed worldwide in whaling activities between 1800 and 1900 (IWC, 1971). With the advent of modern whaling the larger rorqual whales were targeted; however, as their numbers decreased, whaling pressure again focused on smaller rorquals and sperm whales. From 1910 to 1982, there were nearly 700,000 sperm whales killed worldwide from whaling activities (Clarke, 1954; Committee for Whaling Statistics, 1959-1983). Some sperm whales were also taken off the U.S. Mid-Atlantic coast (Reeves and Mitchell, 1988; Perry et al., 1999) and in the northern Gulf of Mexico (Perry et al., 1999). Recorded North Atlantic sperm whale catch numbers for Canada and Norway from 1904 to 1972 total 1,995. All killing of sperm whales was banned by the IWC in 1988.

Sperm whales generally occur in waters greater than 180 meters in depth with a preference for continental margins, seamounts, and areas of upwelling, where food is abundant (Leatherwood and Reeves, 1983). Sperm whales in both hemispheres migrate to higher latitudes in the summer for feeding and return to lower latitude waters in the winter, where mating and calving occur. Mature males typically range to greater latitudes than mature females and

immature animals, but return to the lesser latitudes in the winter to breed (Perry et al., 1999). Waring et al. (1993) suggest sperm whale distribution is closely correlated with the Gulf Stream edge, with a migration to higher latitudes during summer months resulting in concentrations of whales east and northeast of Cape Hatteras. This distribution extends farther northward to areas north of Georges Bank and the Northeast Channel region in summer, then shifts south of New England in fall, back to the Mid-Atlantic Bight (Waring et al., 2002).

Mature females in the northern hemisphere ovulate from April through August. A single calf is born after a 15-month gestation. A mature female will produce a calf every four to six years. Females attain sexual maturity at a mean age of nine years, while males have a prolonged puberty and attain sexual maturity at a mean age of 19 years (Waring et al., 2002). Male sperm whales may not reach physical maturity until they are 45 years old (Waring et al., 2002). The sperm whale's prey consists of larger mid-water squid and fish species (Perry et al., 1999). Sperm whales, especially mature males in greater latitudinal waters, have been observed to take significant quantities of large demersal and deep water sharks, multispecies, and bony fishes.

Few instances of injury or mortality of sperm whales due to human impacts have been recorded in U.S. waters. Between August 1993 and May 1998, three sperm whale entanglements were documented, one each in longline gear (dead floating whale), fine mesh gillnet (disentangled), and net gear (status unknown). Two sperm whale entanglement records exist in the NEFSC bycatch database, and both involve injured whales that were released from pelagic drift gillnet gear (Waring et al., 2002). No mortalities or serious injuries have been directly observed in the pelagic longline, pelagic pair trawl, Northeast multispecies sink gillnet, Mid-Atlantic coastal gillnet, or North Atlantic bottom trawl fisheries (Waring et al., 2002).[35] Ships can also strike sperm whales, but due to the offshore distribution of this species, interactions (both ship strikes and entanglements) that do occur are less likely to be reported than those involving right, humpback, and fin whales that more often occur in nearshore areas. Other impacts noted above for baleen whales may also occur.

As a result of their offshore distribution, sperm whales tend to strand less often than, for example, right and humpback whales. Preliminary data for 2000 indicate that out of ten sperm whales reported to the stranding network (nine dead and one injured), there was one possible fishery interaction, one ship strike (wounded with bleeding gash on side), and eight animals for which no signs of entanglement or injury were sighted or reported.

It has been suggested that another potential human-caused source of mortality for sperm whales may be the accumulation of stable pollutants such as polychlorinated biphenyls (PCBs), chlorinated pesticides, polycyclic aromatic hydrocarbons, and heavy metals. Though not conclusively caused by contaminant burden, tissue samples from 21 sperm whales that mass stranded in the North Sea in 1994/95 showed cadmium levels twice as high as those found in North Pacific sperm whales, possibly affecting the stranded animals' health and behavior (Holsbeek, et al. 1999)

[35] It is important to note that the pelagic drift gillnet fishery no longer exists; therefore, this gear type no longer poses an entanglement threat to this species.

4.3.2.2 Harbor Porpoise

The harbor porpoise (*Phocoena phocoena*) is found in temperate and subpolar waters in the Northern Hemisphere. The species frequents nearshore waters such as bays and estuaries, but also travels in deeper offshore waters. The Gulf of Maine/Bay of Fundy stock includes all harbor porpoise found in the waters of eastern North America south of (and including) Nova Scotia and the Bay of Fundy. The best estimate of abundance for this stock is 89,700, with a minimum population estimate of 74,695 (Waring et al., 2003).

Harbor porpoise prey on small schooling fish, including some fish that are sought by gillnet fishermen. As a result, harbor porpoise can become entangled in gillnets and drown. Gillnets typically used in Northeast and Mid-Atlantic U.S. waters to catch groundfish, such as cod and flounder, have been one source of harbor porpoise mortality and serious injury.[36] In 1993, NMFS proposed to list the Gulf of Maine/Bay of Fundy stock of harbor porpoise under the ESA as threatened. At the time of the proposal, the listing was considered necessary based on analyses of the porpoise bycatch rate in commercial gillnet fisheries.

Following this proposal, NMFS solicited public comment and scientific review to assess questions on the sufficiency and accuracy of bycatch data used in making the "threatened" determination. Average annual estimated harbor porpoise mortality and serious injury in the Northeast sink gillnet fishery from 1994 to 1998 was 1,163. A Take Reduction Team was formed in 1996 to address incidental take of harbor porpoise in the Northeast groundfish sink gillnet and Mid-Atlantic coastal gillnet fisheries. Regulations (63 FR 66464) implementing the Harbor Porpoise Take Reduction Plan (HPTRP) to reduce harbor porpoise bycatch in U.S. Atlantic gillnets were published on December 1, 1998 and became effective January 1, 1999 (63 FR 66464). The Gulf of Maine portion of the HPTRP pertains to all fishing with sink gillnets and other gillnets capable of catching multispecies in New England waters, from Maine through Rhode Island, and includes time and area closures, some of which are complete closures. Other fisheries are closed to multispecies gillnet fishing unless pingers (sound-making devices) are used in the prescribed manner. The Mid-Atlantic portion of the HPTRP pertains to the Mid-Atlantic shore line from New York to North Carolina, and also includes time and area closures.

Since implementation of the HPTRP in 1999, the total average annual harbor porpoise mortality rate has fallen to 365 per year (Waring et al., 2003). Following implementation of the HPTRP, the incidental mortality of harbor porpoise in the Northeast sink gillnet fishery fell to 277 animals between 1999 and 2001. Similar reductions have occurred in the Mid-Atlantic coastal gillnet fishery, with annual average estimated mortality falling from 358 (between 1995 and 1998) to 33 (between 1999 and 2001) (Waring et al., 2003). On January 5, 1999, NMFS determined that the proposed ESA listing was no longer warranted, and on August 2, 2001, the stock was removed from the ESA candidate species list. The species is no longer categorized as an MMPA strategic stock because average annual fishery-related mortality and serious injury has not exceeded PBR for the last three years (Waring et al., 2003).

[36] In addition to incidental takes in U.S. waters, the harbor porpoise is also vulnerable to takes in the Canadian Bay of Fundy groundfish sink gillnet and herring weir fisheries.

4.3.2.3 Dolphins

Pilot whales, and bottlenose, Atlantic white-sided, Risso's, striped, spotted, and common dolphins are protected dolphin species under the MMPA. This section provides further information on the range, abundance, and average annual fishery-related mortality associated with specific stocks of these species that are potentially affected by the ALWTRP.

Western North Atlantic Coastal Bottlenose Dolphin

Researchers once hypothesized that a single coastal migratory stock of bottlenose dolphins existed along the eastern coast of the United States (Blaylock, 1995; Scott et al., 1988). More recent studies show that more than one stock comprises the western north Atlantic (WNA) coastal bottlenose dolphin (*Tursiops truncatus*) stock complex. Additional population structure within the WNA coastal bottlenose dolphin stock complex has been supported and identified based upon genetic, stable isotope ratios of oxygen, photo-identification, and telemetry studies (NMFS, 2001a).

At this time, NMFS believes the coastal bottlenose dolphin stock complex is comprised of seven distinct management stocks with different seasonal components. During the summer months (May to October), three coastal bottlenose dolphin management stocks (the Northern migratory, the Summer Northern North Carolina, and the Summer Southern North Carolina) are found off the waters of New Jersey to North Carolina. During the winter months (November to April), these stocks mix off the North Atlantic coast of North Carolina and have been designated as the winter mixed stock group or management area. Additional year-round management stocks have been identified off South Carolina, Georgia, northern Florida, and central Florida, although the boundaries for these stocks are at present less well-defined. The true population structure likely includes more than the seven stocks identified thus far, and research efforts to better identify the complete stock structure are ongoing. Appendix 4C-1 provides a map of the seven coastal bottlenose dolphin management stocks or units along the Atlantic coast.

One of the first abundance estimates for WNA coastal bottlenose dolphins was conducted in 1995. This 1995 abundance estimate was based upon results from the analyses of a combination of surveys. A new aerial survey to estimate abundance of WNA coastal bottlenose dolphins was conducted in 2002. The resulting estimates are summarized in Exhibit 4-40.

Bottlenose dolphins are known to interact with commercial fisheries and occasionally are taken in various kinds of fishing gear, including gillnets, seines, longlines, shrimp trawls, and crab traps/pots (Waring et al., 2002). Interactions are especially common in near-shore areas where dolphin densities and fishery efforts are greatest. The WNA coastal bottlenose stock complex, a strategic stock, is known to interact with the following eleven commercial fisheries, according to the 2003 MMPA List of Fisheries (LOF): the Mid-Atlantic coastal gillnet fishery, Mid-Atlantic haul/beach seine fishery, Atlantic blue crab trap/pot fishery, North Carolina inshore gillnet fishery, Virginia pound net fishery, North Carolina roe mullet stop net fishery, North Carolina long haul seine fishery, Southeast Atlantic gillnet fishery, Southeastern U.S. Atlantic

shark gillnet fishery, Gulf of Mexico gillnet fishery, and Gulf of Mexico menhaden purse seine fishery.[37]

Exhibit 4-40

2002 ABUNDANCE ESTIMATES FOR THE WESTERN NORTH ATLANTIC COASTAL BOTTLENOSE DOLPHIN BY MANAGEMENT UNIT

Unit	Best Estimate	Coefficient of Variance	Minimum Estimate
SUMMER (May - October)			
Northern Migratory	17,466	19.1	14,621
Northern North Carolina	7,079	45.2	4,083
Southern North Carolina	3,787	106.9	1,987
WINTER (November - April)			
North Carolina Mixed[1]	16,913	23.0	13,558
YEAR ROUND			
South Carolina	2,325	20.3	1,963
Georgia	2,195	29.9	1,716
Northern Florida[2]	448	38.4	328
Central Florida[3]	10,652	45.8	7,377

Notes:
[1] North Carolina mixed includes Northern migratory, Northern North Carolina, and Southern North Carolina.
[2] Northern Florida estimates are derived from the winter 1995 survey and the summer 2002 survey.
[3] Central Florida estimates are derived from the winter 1995 survey.

Source: Garrison et al., 2002.

Of the fisheries listed previously, the Mid-Atlantic coastal gillnet, Southeast Atlantic gillnet, Atlantic coastal blue crab trap/pot, and Southeastern U.S. Atlantic shark gillnet fisheries may be affected by potential revisions to the ALWTRP. The Mid-Atlantic coastal gillnet fishery accounts for the highest documented level of mortality or serious injury of Western North Atlantic coastal bottlenose dolphins: an annual average from 1996 to 2000 of 233 deaths or serious injuries (Waring et al., 2002). In comparison, the shark gillnet fishery has a smaller adverse impact, taking an estimated 24 coastal bottlenose dolphins between 1999 and 2000 (Waring et al., 2002).

In addition to interactions with gillnets, interactions with trap/pot gear may threaten bottlenose dolphins. Between 1994 and 1998, 22 bottlenose dolphin carcasses recovered by the Stranding Network between North Carolina and Florida's Atlantic coast displayed evidence of possible interaction with a trap/pot fishery (i.e., rope and/or traps/pots attached, rope marks).

[37] The 2003 List of Fisheries indicates that the WNA coastal bottlenose stock complex may also interact with the following Category III fisheries: the Delaware Bay inshore gillnet fishery; the Long Island Sound inshore gillnet fishery; the Rhode Island, southern Massachusetts and New York Bight inshore gillnet fishery; the southeastern U.S. Atlantic shrimp trawl fishery; and the Mid-Atlantic menhaden purse seine fishery.

Additionally, at least five dolphins were reported to be released alive (condition unknown) from blue crab traps/pots during this time period (Waring et al., 2002).

Based on recent reports by Palka (2003), NMFS determined that at least some of the coastal bottlenose dolphin stocks are strategic on the basis that the estimated levels of fishing-related mortality and serious injury are greater than their PBR levels. These stocks include the Northern North Carolina management stock during the summer and the North Carolina mixed stock management area during the winter. Inasmuch as NMFS does not currently have observer programs for all fisheries interacting with bottlenose dolphins, the status of the other dolphin stocks relative to PBR is difficult to determine at this time. However, NMFS does have evidence of unofficial observed takes as well as stranding evidence suggesting bottlenose dolphin/fishery interaction problems in some of the other management areas. Using the 2002 PBRs, bycatch estimates from 2000, and predicted bycatch under the status quo, the current fishing-related mortality levels are at or above PBR for the Summer/Northern North Carolina and Winter/North Carolina mixed stock management areas. The PBR levels and estimated 2002 fisheries-related mortality for the seven recognized stocks are summarized in Exhibit 4-41.

Exhibit 4-41
ESTIMATED MORTALITY FOR THE MID-ATLANTIC BEACH-BASED AND OCEAN GILLNET FISHERIES IN 2000 [1] AND CURRENT PBR ESTIMATES FOR WESTERN NORTH ATLANTIC BOTTLENOSE DOLPHIN STOCKS [2]

Stock	Estimated Mortality	Current PBR Estimates[3]
Summer/Northern Migratory	30	73.1
Summer/Northern North Carolina	29	20.4
Summer/Southern North Carolina[4, 5]	0	9.9
Winter/North Carolina Mixed	151	67.8
South Carolina	Unknown	20
Georgia	Unknown	17
Northern Florida	0	3.3
Central Florida[6]	4	74

Notes:

1 Mortality estimates for other fisheries impacting these bottlenose dolphin stocks are unavailable due to lack of observer effort.

2 PBR estimates obtained from recent NMFS reports: Though these values may not precisely match the values found in the most recent Stock Assessment Reports (SAR), these sources include the most recent information available, which will be incorporated into future SARs.

3 PBR estimates are applied semi-annually for management areas north of the North Carolina/South Carolina border. Estimates are applied annually for management areas south of North Carolina.

4 A value of zero designated for estimated mortality indicates that no takes were officially recorded (via the NOAA Fisheries observer program) for the Summer Southern North Carolina Stock in 2000. Friedlaender et al. (2001), however, document two incidences of known takes from the gillnet fishery in southern North Carolina in summer.

5 Seven human interaction strandings were documented in this area during the dolphin summer season following the Friedlaender et al. (2001) publication. Five of these strandings were confirmed to have been caused by fishery interactions (unpublished SEUS Stranding Network data).

6 The PBR for Central Florida is based on a 1995 abundance estimate, as no 2002 estimate is available.

Sources: Palka and Rossman (2003) and (2004), and Palka (2003); and the 1992-2001 bycatch estimates for the Florida shark drift gillnet fishery (Garrison et al., 2001 and 2003).

Other anthropogenic sources of mortality for bottlenose dolphins include pollution and habitat degradation. The nearshore habitat occupied by bottlenose dolphins is adjacent to human populations and, in the northern portion of its range, is highly industrialized. The blubber of stranded dolphins examined during a 1987-88 multiple mortality event along the Atlantic coast contained anthropogenic contaminants in levels among the highest ever recorded (Geraci, 1989).

On October 24, 2001, NMFS announced the creation of a Bottlenose Dolphin Take Reduction Team (BDTRT) and its first meeting (66 FR 53782). The BDTRT met five times before delivering consensus recommendations to NMFS on May 7, 2002. Additionally, the BDTRT met in April 2003 to review updated bottlenose dolphin abundance information and to augment the original recommendations where the Team's recommendations did not meet the statutory requirements of the MMPA. Currently, NMFS is developing a proposed rule to implement some of the recommendations by the BDTRT. It is expected that implementation of the plan will reduce bottlenose dolphin/fishery interactions to below PBR.

Atlantic White-Sided Dolphin

Atlantic white-sided dolphins (*Lagenorhynchus acutus*) are found in temperate and sub-polar waters of the North Atlantic, primarily on continental shelf waters out to the 100-meter depth contour. The species is distributed from central western Greenland to North Carolina, and possibly as far east as 43°00' W. There are possibly three stock units of this species: a Gulf of Maine stock, a Gulf of St. Lawrence stock, and a Labrador Sea stock (Palka et al., 1997). The Gulf of Maine stock is commonly found in continental shelf waters from Hudson Canyon to Georges Bank and into the Gulf of Maine to the Bay of Fundy. The best estimate of abundance for the Gulf of Maine Atlantic white-sided dolphin stock is 51,640, and the minimum estimate is 37,904 (Waring et al., 2003). The PBR for this stock is approximately 364 (Waring et al., 2003).

Atlantic white-sided dolphins have become entangled in Northeast sink gillnet, Mid-Atlantic coastal gillnet, pelagic drift gillnet, North Atlantic bottom trawl, and Atlantic squid, mackerel, and butterfish trawl fisheries. The estimated total take of Gulf of Maine stock Atlantic white-sided dolphins in all U.S. fisheries was 102 dolphins per year from 1997 to 2001 (Waring et al., 2003). Approximately 59 of these mortalities are attributable to the Northeast sink gillnet fishery, 32 are attributable to the squid, mackerel, butterfish trawl fishery, nine are attributable to the Mid-Atlantic coastal gillnet fishery, and two are attributable to the Gulf of Maine/Georges Bank herring trawl fishery (Waring et al., 2003).[38] The Northeast sink gillnet and the Mid-Atlantic coastal gillnet fisheries are currently regulated under the ALWTRP.

Risso's Dolphin

The Risso's dolphin (*Grampus griseus*) is found worldwide in tropical and temperate waters. The western North Atlantic stock occurs along the continental shelf from Cape Hatteras to Georges Bank. Based on limited survey estimates in U.S. waters, the best estimate of Risso's

[38] Average annual fishery-related mortality estimates are based on observer data between 1990 and 2001.

dolphin abundance is 29,110, and the minimum estimate is 22,916 (Waring et al., 2002). Based on these data, the PBR for the western North Atlantic stock of Risso's dolphins is approximately 220 dolphins per year.

According to observer records from 1996-2000, this species has been observed as bycatch in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, and the Northeast multispecies sink gillnet fisheries. Between 1996 and 2000, the estimated mean mortality of Risso's dolphins taken in the pelagic longline fishery was 48 (CV = 0.55) and was 3 (CV = 1.06) for the Northeast multispecies sink gillnet fishery (Waring et al., 2002). The current estimated mortality rate does not include the estimated mortality of nine dolphins in 1998 associated with the pelagic drift gillnet fishery and the estimated mortality of 3.7 dolphins in 1995 associated with the pelagic pair trawl fishery, since these fisheries no longer exist (Waring et al., 2002). [39] The Northeast sink gillnet fishery is currently regulated under the ALWTRP.

Pelagic Delphinids (Spotted Dolphin, Striped Dolphin, Pilot Whale, Offshore Bottlenose Dolphin, Common Dolphin)

The pelagic delphinid complex is made up of small odontocete species that are broadly distributed along the continental shelf edge where depths range from 200 - 400 meters. These species include the western North Atlantic stock of spotted dolphins, western North Atlantic stock of striped dolphins, western North Atlantic stock of pilot whales, the western North Atlantic offshore stock of bottlenose dolphins, and the western North Atlantic stock of common dolphins.

Spotted Dolphin

There are two species of spotted dolphin in the Western Atlantic, which are difficult to differentiate at sea – the Atlantic spotted dolphin, *Stenella frontalis*, and the pantropical spotted dolphin, *S. attenuata*. Atlantic spotted dolphins are distributed from southern New England south through the Gulf of Mexico and the Caribbean to Venezuela (Waring et al., 2000). Pantropical spotted dolphins are distributed worldwide in tropical and some sub-tropical oceans, occur in the Gulf of Mexico in all seasons, and also occur between Nova Scotia and Florida (Waring et al., 2002). These dolphins are commonly found in large groups that feed on schools of fish. Spotted dolphins are known to feed on a variety of prey items, including small-to-large epipelagic and mesopelagic fishes and squids, and benthic invertebrates (Perrin et al., 2002).

The best estimate of abundance for Atlantic spotted dolphins is 52,279 (combined estimates for offshore, 15,840 and coastal, 36,439), and the minimum population estimate for this stock is 27,785. Based on these data, the combined PBR for the offshore and coastal forms of the western North Atlantic stock of Atlantic spotted dolphins is 278 (Waring et al., 2000). The best estimate of abundance for pantropical spotted dolphins is 13,117, and the minimum

[39] Average annual fishery-related mortality estimates are based on observer data between 1990 and 2000.

population estimate for this stock is 8,450. Based on these data, the PBR for the Western North Atlantic stock of pantropical dolphins is 84 (Waring et al., 2002).

Bycatch of spotted dolphins has been observed by NMFS Sea Samplers in the pelagic drift gillnet and pelagic longline fisheries, but no mortalities or serious injuries have been documented in the pelagic pair trawl, Northeast multispecies sink gillnet, mid-Atlantic coastal gillnet, and North Atlantic bottom trawl fisheries.[40] The total annual estimated average fishery-related mortality or serious injury to this stock during 1996-2000 was 0 undifferentiated spotted dolphins (*Stenella* spp.) (Waring et al., 2002).

Striped Dolphin

Striped dolphins (*Stenella coeruleoalba*) are found in the western North Atlantic from Nova Scotia south to at least Jamaica, in the Gulf of Mexico, and in general prefer continental slope waters offshore to the Gulf Stream (Waring et al., 2000). These dolphins, like spotted dolphins, are commonly found in large groups that feed on schools of fish. Striped dolphins feed on a variety of pelagic or benthopelagic fish and squid, and in the Northeast Atlantic, they primarily feed on cod (Perrin et al., 2002). The best estimate of abundance for striped dolphins is 61,546, and the minimum population estimate for this stock is 44,500. Based on these data, the PBR for the western North Atlantic striped dolphin is 445 (Waring et al., 2000).

Bycatch of striped dolphins has been observed by NMFS Sea Samplers in the pelagic drift gillnet and North Atlantic bottom trawl fisheries, but no mortalities or serious injuries have been documented in the pelagic longline fisheries, pelagic pair trawl, Northeast multispecies sink gillnet, and Mid-Atlantic coastal gillnet fisheries (Waring et al., 2000).[41] Between 1994 and 1998, the total annual estimated average fishery-related mortality to this stock was 7.3 striped dolphins (CV = 0.08).

Pilot Whale

Pilot whales (*Globicephala melas* and *Globicephala macrorhynchus*) are found in the Gulf Stream and continental shelf and slope waters. The best estimate of the two pilot whale species – the long-finned and short-finned - abundance is 14,524, and the minimum estimate is 11,343 (Waring et al., 2003). Based on these data, the PBR for the western North Atlantic stock of pilot whales is approximately 108.

Pilot whale bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, bluefin tuna purse seine, North Atlantic bottom trawl, Atlantic squid, mackerel, butterfish trawl, and Mid-Atlantic coastal gillnet fisheries, but no mortalities or serious injuries have been documented in the Northeast multispecies sink gillnet

[40] Waring et al. (2002) note that the pelagic drift gillnet and the pelagic pair trawl fisheries no longer exist.

[41] Waring et al. (2000) note that the pelagic drift gillnet and the pelagic pair trawl fisheries no longer exist.

fishery.[42] Based on observer data, the estimated annual average fishery-related mortality or serious injury to the western North Atlantic stock attributable to U.S. fisheries was 215 pilot whales (both species combined) from 1997 through 2001. Of these deaths, 117 are associated with the pelagic longline fishery, 46 are associated with the Southern New England/Mid-Atlantic mixed groundfish trawl fisheries, 40 are associated with the Southern New England/Mid-Atlantic squid, mackerel, butterfish trawl fishery, 11 are associated with the Northeast Atlantic (Gulf of Maine/Georges Bank) herring fishery, and one is associated with the Mid-Atlantic coastal gillnet fishery (Waring et al., 2003). The latter fishery is currently regulated under the ALWTRP. The estimated mortality rate does not include the estimated mortality of 12 dolphins in 1998 associated with the pelagic drift gillnet fishery and the estimated mortality of 22 dolphins in 1995 associated with the pelagic pair trawl fishery, since these fisheries no longer exist (Waring et al., 2003).[43]

An additional potential human-caused source of mortality for pilot whales is from polychlorinated biphenyls (PCBs) and chlorinated pesticides; moderate levels of which have been found in pilot whale blubber (Taruski, 1975; Muir et al., 1988; Weisbrod et al., 2000b). In addition, high levels of toxic metals, selenium, and PCBs were measured in pilot whales killed in the Faroe Islands (Nielsen et al., 2000; Dam and Bloch, 2000). The population effect of the observed levels of such contaminants is currently unknown (Waring et al., 2003).

Offshore Bottlenose Dolphin

The western North Atlantic offshore stock of bottlenose dolphins (*Tursiops truncatus*) ranges from Florida to Georges Bank along the continental slope. The best estimate of abundance is 29,774, and the minimum estimate is 24,199. Based on these data, the PBR for the stock is 242 dolphins (Waring et al., 2003). Bottlenose dolphins are among the most frequently stranded small cetaceans along the Atlantic coast. Many of these stranded animals show signs of human interaction, such as net marks and mutilation (Waring et al., 2003).[44]

Offshore bottlenose dolphin bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, North Atlantic bottom trawl, Northeast multispecies sink gillnet, and Mid-Atlantic coastal gillnet fisheries.[45] The estimated annual average fishery-related mortality or serious injury to the western North Atlantic stock attributable to U.S. fisheries was 27 bottlenose dolphins from 1996 through 2000. Of these deaths, 26 are associated with the Northeast multispecies sink gillnet fishery and one is associated with the Mid-Atlantic coastal gillnet fishery (Waring et al., 2003). Both of these fisheries are currently regulated under the ALWTRP. The estimated mortality rate does not include the estimated mortality of three dolphins in 1998 associated with the pelagic drift gillnet fishery and the

[42] Waring et al. (2003) note that the pelagic drift gillnet and the pelagic pair trawl fisheries no longer exist.

[43] Average annual fishery-related mortality estimates are based on observer data between 1990 and 2001.

[44] Average annual fishery-related mortality estimates are based on observer data between 1990 and 2001.

[45] Waring et al. (2003) note that the pelagic drift gillnet and the pelagic pair trawl fisheries no longer exist.

estimated mortality of 17 dolphins in 1995 associated with the pelagic pair trawl fishery, since these fisheries no longer exist (Waring et al., 2003).

Common Dolphin

Common dolphins (*Delphinus delphis*) may be among the most widely distributed cetacean species; they range worldwide in temperate, sub-tropical, and tropical waters. The western North Atlantic stock occurs most frequently north of Cape Hatteras along the continental shelf. The best estimate of western North Atlantic stock abundance is 30,768 common dolphins; the minimum estimate is 23,655. Based on these data, the PBR is 227 common dolphins (Waring et al., 2003).

Common dolphin bycatch has been observed by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, North Atlantic bottom trawl, Atlantic squid, mackerel, butterfish trawl, Northeast multispecies sink gillnet, and Mid-Atlantic coastal gillnet fisheries.[46] Based on observer data, the estimated annual average fishery-related mortality or serious injury to the western North Atlantic stock attributable to U.S. fisheries was 190 common dolphins from 1997 through 2001. Of these deaths, 90 are associated with the squid, mackerel, butterfish trawl fishery, 32 are associated with the Southern New England/Mid-Atlantic mackerel trawl fishery, 29 are associated with the Northeast multispecies sink gillnet fishery, 19 are associated with the Southern New England/Mid-Atlantic mixed bottom trawl fisheries, 17 are associated with the Southern New England/Mid-Atlantic mackerel joint venture fishery, and 3 are associated with the Mid-Atlantic coastal gillnet fishery (Waring et al., 2003). Also, between 1990 and 2000, 16 common dolphins were hooked and released alive from the pelagic longline fishery (Yeung et al., 2000; Yeung, 2001 as found in Waring et al., 2003). The Northeast multispecies sink gillnet and the Mid-Atlantic coastal gillnet fisheries are currently regulated under the ALWTRP. The estimated mortality rate does not include the estimated mortality of 255 dolphins in 1998 associated with the pelagic drift gillnet fishery and the estimated mortality of 5.6 dolphins in 1995 associated with the pelagic pair trawl fishery, since these fisheries no longer exist (Waring et al., 2003).[47]

4.3.2.4 Seals

Harbor Seal

The harbor seal (*Phoca vitulina*) is found in all nearshore waters of the Atlantic Ocean above 30 degrees latitude (Waring et al., 2003). 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 the Carolinas (Boulva and McLaren, 1979; Gilbert and Guldager,

[46] Waring et al. (2003) note that the pelagic drift gillnet and the pelagic pair trawl fisheries no longer exist.

[47] Average annual fishery-related mortality estimates are based on observer data between 1990 and 2001.

1998). It is believed that the harbor seals found along the U.S. and Canadian east coasts represent one population (Waring et al., 2003). Harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine, and occur seasonally along the southern New England and New York coasts from September through late May. However, breeding and pupping normally occur only in waters north of the New Hampshire/Maine border.

Since passage of the MMPA in 1972, the number of seals found along the New England coast has increased nearly five-fold, with the number of pups seen along the Maine coast increasing at an annual rate of 12.9 percent during the 1981 to 1997 period (Gilbert and Guldager, 1998). The minimum population estimate for harbor seals is 91,546 based on corrected total counts along the Maine coast in 2001 (Waring et al., 2003). The maximum productivity rate is assumed to be 0.12, the default value for pinnipeds.[48] The recovery factor for this stock is 1.0, the value for stocks of unknown status but known to be increasing. PBR for U.S. waters is 5,493 (Waring et al., 2003).

Incidental takes of harbor seals have been recorded in groundfish gillnet, herring purse seine, halibut tub trawl, and lobster fisheries (Gilbert and Wynne, 1985 and 1987). Mortalities involving the herring purse seine, halibut tub trawl, and lobster fisheries are reportedly rare.

The Northeast multispecies sink gillnet fishery is responsible for the majority of harbor seal fishery takes on the East Coast of the United States. This fishery is located in the Gulf of Maine and in Southern New England. Between 1990 and 2001 there were 394 observed harbor seal mortalities attributable to this fishery. According to Waring et al. (2003), the estimated total mortality of harbor seals by year (CV in parentheses) is 602 in 1990 (0.68), 231 in 1991 (0.22), 373 in 1992 (0.23), 698 in 1993 (0.19), 1,330 in 1994 (0.25), 1,179 in 1995 (0.21), 911 in 1996 (0.27), 598 in 1997 (0.26), 332 in 1998 (0.33), 1,471 in 1999 (0.34), 917 in 2000 (0.43), and 1471 in 2001 (0.38). Average annual estimated fisheries-related mortality and serious injury to this stock attributable to this fishery from 1997 to 2001 was 953 harbor seals (CV=0.18), which is well below the PBR for this species (Waring et al., 2003).

The Mid-Atlantic coastal gillnet fishery was responsible for a minimal number of takes on observed trips during 1993-1997 and 1999-2001, with observers recording two mortalities, both in 1998 (Waring et al., 2003). Observed effort was concentrated off New Jersey and scattered between Delaware and North Carolina from one to 50 miles off the beach. Based on the observer coverage in this fishery, estimated mortality attributed to this fishery was zero from 1995 to 1997 and 1999 to 2001, and 11 in 1998 (0.77). The average annual estimated fishery-related mortality attributable to this fishery from 1997 to 2001, was two animals (CV=0.77) (Waring et al., 2003).

Additional sources of mortality for harbor seals include boat strikes, entrainment in power plant intakes (12-20 per year; NMFS unpublished data), oil contamination, shooting (around salmon aquaculture sites and fixed fishing gear), storms, abandonment by the mother, and disease (Katona *et al*. 1993; NMFS unpublished data).

[48] This value is based on theoretical modeling showing that pinniped populations may not grow at rates greater than 12 percent given the constraints of their reproductive life history.

Gray Seal

The gray seal (*Halichoerus grypus*) is found on both sides of the North Atlantic, with the western North Atlantic population occurring from New England to Labrador. 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. There are several small breeding colonies on isolated islands along the coast of Maine and on outer Cape Cod and Nantucket Island in Massachusetts (Waring et al., 2003). The population estimate for the Sable Island and Gulf of St. Lawrence breeding groups was 143,000 in 1993. The population in waters off Maine increased from about 30 in the early 1970s to between 500 and 1,000 animals in 1993 and between 1,500 and 1,700 in 2001. Recently, 29-49 pups per year have been recorded at one pupping site in Penobscot Bay, and in the winter of 2000, approximately 150 gray seals (adults and pups) were observed at a second pupping site (Waring et al., 2003). The gray seal population in Massachusetts increased from 2,010 in 1994 to 5,611 in 1999 between the Isles of Shoals, New Hampshire and Woods Hole, Massachusetts, although it is not clear how much of this increase may be due to animals emigrating from northern areas. The minimum population size for gray seals is unknown. The maximum productivity rate is 0.12, the default value for pinnipeds. The recovery factor for this stock is 1.0, the value for stocks of unknown status but is known to be increasing. PBR for U.S. waters is unknown (Waring et al., 2003).

Gray seals, like harbor seals, were hunted for bounty in New England waters until the late 1960s. This hunt may have severely depleted this stock in U.S. waters (Rough, 1995). 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 (Lavigueru and Hammill, 1993). By the mid-1900s, gray seals were considered to be rare, and in the mid-1960s, the population in eastern Canada was estimated to be 5,600 (Mansfield, 1966). Since the mid-1960s the population has been increasing. During a bounty program (1976-1983) and a culling program (1967-1983), the average annual removals were 720 and 1,000 seals, respectively (Fisheries and Oceans Canada, 2001). Between 1993-2000, the annual kill of gray seals by hunters was: 1993 (0), 1994 (40), 1995 (364), 1996 (132), 1997 (72), 1998 (275), 1999 (98), and 2000 (342) (Waring et al., 2003). The traditional hunt continued in 2002 and 2003, with 76 and 126 gray seals taken, respectively, off the Magdalen Islands and in other areas, except Sable Island, where commercial hunting is not permitted (Fisheries and Oceans Canada, 2003).

An unknown level of mortality also occurs in the mariculture industry (*i.e.*, salmon farming) and by deliberate shooting (NMFS, unpublished data). In addition, the Cape Cod stranding network has documented several animals with netting or plastic debris around their necks in the Cape Cod/Nantucket area. Between 1997 and 2001, 197 gray seal strandings were recorded, extending from Maine (25) to North Carolina (1). Most of the strandings occurred in Massachusetts (72), followed by New York (55), and Maine (25). Twenty-three animals showed signs of human interactions: fishery (8), power plant (3), oil spill (6), shot (1), mutilated (1), boat strike (1), and other (3) (Waring et al., 2003). 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 wash ashore, nor will all of those that do wash ashore necessarily show signs of entanglement or other fishery interaction.

Fisheries interactions with gray seals take place primarily in the Northeast multispecies sink gillnet fishery in the Gulf of Maine and in Southern New England. There were 47 gray seal mortalities observed in this fishery between 1993 and 2001. Estimated annual mortalities (CV in parentheses) of this species between 1990 and 2001 include 0 takes 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), and 117 in 2001 (0.59). Based on observer data, the average annual estimated mortality and serious injury attributable to this fishery from 1997 to 2001 was 131 gray seals (CV=0.26) (Waring et al., 2003).

Harp Seal

The harp seal (*Phoca groenlandica*) occurs throughout much of the North Atlantic and Arctic Oceans and has been increasing off the East Coast of the United States from Maine to New Jersey. Harp seals are usually found off the U.S. from January to May, when the western stock of harp seals is at its most southern point of migration (Waring et al., 2003). Harp seals congregate on the edge of the pack ice from February through April, when breeding and pupping take place. The harp seal is highly migratory, moving north and south with the edge of the pack ice. Non-breeding juveniles will migrate the farthest south in the winter, but the entire population moves north toward the Arctic in the summer. The minimum population estimate for the western North Atlantic is 5.2 million seals in Canada, and present data are insufficient to calculate the minimum population estimate for U.S. waters (Waring et al., 2003). The maximum productivity rate is assumed to be 0.12, the default value for pinnipeds. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to OSP was set at 1.0 because it was believed that harp seals are within OSP. PBR for the western North Atlantic harp seals in U.S. waters is unknown (Waring et al., 2003). Applying the formula to the minimum population estimate for Canadian waters results in a PBR of 312,000 harp seals. However, Johnston et al. (2000) suggest that catch statistics from the Canadian hunt are negatively biased due to underreporting; therefore, a recovery factor of 0.5 would be appropriate. Using the lower recovery factor results in a PBR of 156,000 harp seals (Waring et al., 2003).

A large number of harp seals are killed in Canada, Greenland, and the Arctic. For 2003 to 2005, the Canada Department of Fisheries and Oceans has set the three-year total allowable catch (TAC) of harp seals at 975,000, with an annual TAC of up to 350,000 in any two years provided that the combined TAC over three years is maintained by a reduction in the TAC in the other years (Fisheries and Oceans Canada, 2003). In addition, annual harp seal mortalities in Greenland and the Arctic may exceed 100,000 (Waring et al., 2003).

Recent bycatch has been observed by NMFS Sea Samplers in the Northeast multispecies sink gillnet, but no mortalities have been documented in the Mid-Atlantic coastal gillnet, Atlantic drift gillnet, pelagic pair trawl, or pelagic longline fisheries (Waring et al., 2003). The majority of fisheries-related mortality in harp seals can be attributed to the Northeast multispecies sink gillnet fishery. This fishery is based in the Gulf of Maine and in Southern New England. There were 122 harp seal mortalities observed between 1990 and 2001. Estimated annual mortalities (CV in parentheses) from this fishery between 1990 and 2001 were 0 during 1990-1993, 861 in

1994 (0.58), 694 in 1995 (0.27), 89 in 1996 (0.55), 269 in 1997 (0.50), 78 in 1998 (0.48), 81 in 1999 (0.78), 24 in 2000 (0.30), and 26 in 2001 (1.04). The average estimated fishery-related mortality and serious injury to this stock from the Northeast multispecies sink gillnet fishery from 1997 to 2001 was 96 harp seals (CV=0.33) (Waring et al., 2003).

Harp seal interactions with the Mid-Atlantic coastal gillnet fishery have been minimal since observer coverage began in 1993. No harp seals were taken on observed trips during 1993-1997 or from 1999-2001. One take was recorded in 1998. 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), and 0 in 1999-2001. Average annual estimated fishery-related mortality attributable to this fishery between 1997 and 2001 was 3.0 harp seals (CV=1.02) (Waring et al., 2003).

Vessels in the North Atlantic bottom trawl fishery, a Category III fishery under the MMPA, were observed in order to meet fishery management needs rather than marine mammal management needs. The fishery is active in all seasons in New England waters. No harp seal mortalities were observed between 1991-2000, and one mortality was observed in 2001. The estimated annual fishery-related mortality and serious injury attributable to this fishery (CV in parentheses) was 0 between 1991-2000, and 49 (CV=1.10) in 2001. The average annual estimated fishery-related mortality attributable to this fishery in 2001 was 10 harp seals (CV=1.10). However, these estimates should be viewed with caution since observer coverage was extremely low (less than one percent) (Waring et al., 2003).

4.3.2.5 Sea Turtles

Kemp's ridley, loggerhead, leatherback, green, and hawksbill sea turtles spend all or part of the year in the waters potentially affected by new ALWTRP regulations. Sea turtles continue to be affected by many of the original threats that prompted their ESA listing, including interactions with fishing gear, degradation of nesting beach sites, poaching, vessel strikes,[49] dredging, and marine pollution (including ingestion of marine debris) (Lutcavage et al., 1997).[50] Few of these impacts, however, have been quantified with any degree of confidence. Observer programs implemented for dredging and some commercial fisheries have begun to measure the effects of these activities on sea turtle populations.

[49] Sea turtle stranding data for the U.S. Gulf of Mexico and Atlantic coasts, Puerto Rico, and the U.S. Virgin Islands show that between 1986 and 1993, about nine percent of living and dead stranded sea turtles had propeller or other boat strike injuries. According to 2001 Sea Turtle Stranding & Salvage Network (STSSN) data, at least 33 sea turtles (loggerhead, green, Kemp's ridley, and leatherbacks) that stranded on beaches between Maine and North Carolina were struck by a boat.

[50] Marine turtles have been found to ingest a wide variety of ocean debris such as plastic bags, raw plastic pellets, plastic and Styrofoam pieces, and tar ball sand balloons. Effects of debris ingestion can include direct obstruction of the gut, absorption of toxic byproducts, and reduced absorption of nutrients across the gut wall.

Kemp's Ridley Sea Turtle

Less than fifty years ago, the Kemp's ridley (*Lepidochelys kempii*) was an abundant sea turtle in the Gulf of Mexico. Since then, the Kemp's ridley has experienced one of the most dramatic population declines recorded for any animal. In 1947, an estimated 42,000 females nested during one day on the species' single known nesting beach along the northeastern coast of Mexico. In 1985, the Kemp's ridley population fell to an all-time low, with only 300 nesting females found in the same location.[51] The population crash that occurred between 1947 and the early 1970s is believed to be the result of both intensive egg harvesting and mortality of juveniles and adults in trawl fisheries.

The Kemp's ridley was listed as endangered under the ESA on December 2, 1970. Internationally, the Kemp's ridley is considered to be the most endangered sea turtle, and is protected from international trade. Today, under strict protection both in the U.S. and Mexico, the population appears to be in the earliest stages of recovery; current totals exceed 3,000 nests per year (Turtle Expert Working Group, 2000). Current rates of increase have been estimated at 11.3 percent per year, and it is expected that the population of nesting females will reach 10,000 around 2020. This increase can be attributed to two primary factors: full protection of nesting females and their eggs in Mexico, and the requirement to use turtle excluder devices (TEDs) in shrimp trawls both in the U.S. and Mexico.

Over the 12-year period from 1986 to 1997, 69 percent of Kemp's ridley strandings occurred in the Gulf of Mexico, 25 percent in the southeast Atlantic, and six percent in the northeast Atlantic (Turtle Expert Working Group, 2000). Strandings over this time period have increased approximately 70 percent, with increases confined to the southeast and Gulf of Mexico. The western Gulf of Mexico, where shrimp fishing effort is consistently high, has accounted for the highest proportion of Kemp's ridley strandings, particularly of adults. An estimated 500 to 5,000 benthic immature and adult Kemp's ridley mortalities were attributed to shrimp trawling prior to the implementation of TED regulations (NRC, 1990).[52] Other significant threats facing Kemp's ridleys include degradation of nesting beach habitat from human development; marine pollution[53] and floating debris; and offshore oil and gas exploration operations.[54]

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[51] Because nearly the entire adult female population nests at a single locality (about 60 km of beach on the east coast of Mexico), it is possible to estimate the female reproductive population by counting the nests at this site.

[52] This compares to 75 to 750 estimated mortalities due to all other known human causes.

[53] The impact of heavy metals and pesticides on the physiology and behavior of sea turtles is not documented. Because Kemp's ridley is a carnivore, however, the species is vulnerable to the bio-accumulation of chemicals. In addition, intensive industrial and agricultural development along the northern Gulf coast raises the potential for increased levels of chemical exposure for the species.

[54] The Gulf of Mexico is an area of high-density offshore oil extraction with chronic, low-level spills and occasional massive spills (such as the explosion and destruction of a loaded supertanker, the *Mega Borg*, near Galveston in 1990). The two primary feeding grounds for adult Kemp's ridleys in the northern and southern Gulf of Mexico are both near major areas of near-shore and off-shore oil exploration and production.

Kemp's ridleys are known to have been incidentally taken in various types of fishing gear. From tag returns of turtle strandings, juvenile ridleys are known to have been caught in shrimp trawls, hook and line gear, gill nets, dip nets, beach seines, cast nets, butterfly nets, and crab traps/pots (Manzella et al., 1988). Tag returns for adult turtles indicate that interactions have occurred with shrimp trawls, gill nets, fish trawls, hook and line gear, purse seines, and beach seines (Marquez et al., 1989).[55] Strandings of Kemp's ridleys in Virginia indicate that they may also be susceptible to interactions with the state pound net fishery (NMFS, 2004a). For more detailed information on interactions between Kemp's ridley turtles and ALWTRP-related gear, see Chapter 9, section 9.4.2.5.

Loggerhead Sea Turtle

The loggerhead sea turtle (*Caretta caretta*) is the most abundant of the sea turtles listed as endangered or threatened in U.S. waters. Loggerheads are circumglobal, inhabiting continental shelves, bays, estuaries, and lagoons in temperate, subtropical, and tropical waters. They commonly occur throughout the inner continental shelf from Florida through Cape Cod, Massachusetts. Loggerhead sea turtles are found in Virginia foraging areas as early as April, but are not usually found on the most northern foraging grounds in the Gulf of Maine until June. The large majority leave the Gulf of Maine by mid-September, but some may remain in Mid-Atlantic and northeast waters until late fall. During November and December, loggerheads appear to concentrate in nearshore and southerly areas influenced by warmer Gulf Stream waters off North Carolina. Summer nesting usually occurs in the lower latitudes. Primary Atlantic nesting sites are along the east coast of Florida, with additional sites in Georgia, the Carolinas, and the Gulf Coast of Florida. Because female loggerhead sea turtles exhibit nest fidelity, western Atlantic loggerhead sea turtles can be genetically identified as originating from one of five nesting groups. This also means that in the event a nesting group is lost, it is unlikely to be recolonized by another nesting group. Based on nesting data, the south Florida-nesting and northern-nesting groups are the largest of the western Atlantic loggerhead nesting groups, representing approximately 90.7% and 8.5% of the total annual western Atlantic loggerhead nests (Turtle Expert Working Group, 2000; SEFSC, 2001). Recent analyses, including nesting data through 2003, indicate that there is no discernible trend in the status of either the south Florida or northern nesting group (B. Witherington, pers. comm., 2004; Turtle Expert Working Group, 2000).

The loggerhead sea turtle was listed as threatened under the ESA on July 28, 1978, but is considered endangered by the International World Conservation Union (IUCN). The most significant threats to loggerhead populations in the Atlantic are commercial fisheries, coastal development and erosion of nesting beaches, and pollution (including ingestion of marine debris). Other major threats include marine habitat degradation and vessel strikes. Loggerhead strandings occur throughout the eastern U.S., with the majority occurring along the southeast Atlantic coast.

[55] This study was based exclusively upon the returns of tags from stranded tagged turtles. Causes of mortality for the larger number of untagged turtles were not examined.

Loggerhead turtles are captured and injured or killed in interactions with a variety of fishing gear, including whelk pots, gillnets, pelagic longlines, trawls, and scallop dredges. They are also susceptible to entanglement and impingement in pound net gear in Virginia state waters (NMFS 2004). See Chapter 9, section 9.4.2.5 for detailed information on these interactions.

Leatherback Sea Turtle

The leatherback sea turtle (*Dermochelys coriacea*) is the largest living turtle and is distinct from other sea turtle species because of its rubber-like, flexible carapace. Like the loggerhead, the leatherback is circumglobal. In the northwestern Atlantic, the leatherback turtle's range extends from Cape Sable, Nova Scotia, south to Puerto Rico and the U.S. Virgin Islands. Nesting occurs from February through July at sites located from Georgia to the U.S. Virgin Islands. During the summer, leatherbacks tend to be found along the east coast of the U.S. from the Gulf of Maine south to the middle of Florida.

A global collapse of the leatherback sea turtle population was precipitated by a tremendous overharvest of eggs and adults along the Pacific coasts of Mexico, Costa Rica, and Malaysia. Nesting along the Pacific coast of Mexico has declined at an annual rate of 22 percent over the last 12 years, and the Malaysian population today represents one percent of recorded levels in the 1950s. Listed as endangered on June 2, 1970, current estimates place the number of female leatherbacks at 20,000 to 30,000 worldwide. Estimates of leatherback nesting populations, however, are especially difficult to discern because nesting females frequently change beaches. The population of leatherback sea turtles in the Atlantic Ocean does not appear to be increasing; it is either declining or stable depending on whether conservative or optimistic estimates are accepted.

Among U.S. commercial fisheries, the southeast shrimp trawl fishery is known to take the highest number of leatherback sea turtles. Henwood and Stuntz (1987) estimated the offshore commercial shrimp fleet captures about 640 leatherbacks annually in the southeastern United States. Approximately 25 percent (160) of the captured animals die from drowning.[56] Leatherbacks are also susceptible to injury or mortality resulting from interactions with gillnet, pelagic longline, and trap/pot gear. Strandings of leatherback turtles in Virginia indicate that they may also be susceptible to interactions with the state pound net fishery (NMFS, 2004a). For detailed information on fishing gear interactions, see Chapter 9, section 9.4.2.5.

Other major threats facing the leatherback sea turtle in the Atlantic Ocean include marine pollution (including ingesting marine debris), development and erosion of nesting beach sites, and vessel strikes.[57]

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[56] The use of TEDs by the shrimp industry does not significantly reduce leatherback captures and mortality because TEDs are generally incapable of passing adult leatherbacks through the exit opening.

[57] According to 1980-1999 Sea Turtle Stranding & Salvage Network (STSSN) data, the number of leatherback strandings involving boat strikes or collisions (231) was considerably greater than the number of strandings involving entanglement in fishing gear (81), ingestion of marine debris (36), or some kind of intentional interaction (i.e., gaff wounds or rope deliberately tied to a flipper) (21) combined. In most cases, however, it is not known whether a boat strike was the cause of death or whether the strike occurred post-mortem (SEFSC, 2001).

Green Sea Turtle

Green sea turtles (*Chelonia mydas*) are distributed circumglobally. In the western Atlantic they range from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean, but are considered rare north of Cape Hattaras (Wynne and Schwartz, 1999). Green turtles were traditionally highly prized for their flesh, fat, eggs, and shell, and directed fisheries in the U.S. and throughout the Caribbean are largely to blame for the decline of the species. In the Gulf of Mexico, green turtles were once abundant enough in the shallow bays and lagoons to support a commercial fishery. However, declines in the turtle fishery throughout the Gulf of Mexico were evident by 1902 (Doughty, 1984).

In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart, 1979). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, and at beaches on the Florida panhandle (Meylan, et al., 1995). The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the ten years of regular monitoring, perhaps due to increased protective legislation throughout the Caribbean (Meylan, et al., 1995). Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past. Recent population estimates for the western Atlantic area are not available.

As is the case for loggerhead and Kemp's ridley sea turtles, green sea turtles use Mid-Atlantic and northern areas of the western Atlantic coast as important summer developmental habitat. Like other marine turtle species, green turtle hatchlings initially enter the pelagic environment. After reaching a certain size, juveniles enter benthic foraging areas where they consume a primarily herbivorous diet. Along the U.S. western Atlantic coast, green turtles are found in estuarine and coastal waters as far north as Long Island Sound, Chesapeake Bay, and North Carolina (Musick and Limpus, 1997). Like loggerheads and Kemp's ridleys, green sea turtles that use northern waters during the summer must return to warmer waters when water temperatures drop, or face the risk of cold stunning.[58] Cold stunning of green turtles may occur in southern areas as well (i.e., Indian River, Florida), as these natural mortality events are dependent on water temperatures and not solely geographical location.

Green turtles face many of the same natural threats as loggerhead and Kemp’s ridley sea turtles. In addition, green turtles appear to be susceptible to fibropapillomatosis, an epizootic disease producing lobe-shaped tumors on the soft portion of a turtle’s body. Juveniles are most commonly affected. The occurrence of fibropapilloma tumors may result in impaired foraging, breathing, or swimming ability, leading potentially to death. Stranding reports indicate that between 200 and 400 green turtles strand annually along the Eastern U.S. coast from a variety of causes, most of which are unknown (STSSN database).

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging,

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[58] Cold stunning refers to the condition observed in sea turtles that have been exposed to very sudden decreases in water temperature. Affected animals generally become lethargic and float to the surface. In extreme cases, death may occur.

pollution, and habitat destruction account for an unknown level of other mortality. Sea sampling coverage in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. Strandings of green turtles in Virginia indicate that they may also be susceptible to interactions with the state pound net fishery (NMFS, 2004a).

Hawksbill Sea Turtle

The hawksbill sea turtle (*Eretmochelys imbricata*) is relatively uncommon in the waters of the Northeast or Mid-Atlantic. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America, where they feed primarily on a wide variety of sponges and mollusks. There are accounts of small hawksbills stranded as far north as Cape Cod, Massachusetts. However, many of these strandings were observed after hurricanes or offshore storms. No fisheries-related takes of hawksbill sea turtles have been observed in the Northeast or Mid-Atlantic (NMFS, 2003a).

4.4 HABITAT

Modification of the ALWTRP may also affect essential fish habitat (EFH). Under the Magnuson-Stevens Act (MSA) (16 U.S.C. 1801) EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” (16 U.S.C. 1802(10)). To help guide regional Fisheries Management Councils (Councils) in the implementation of EFH provisions, regulations developed by the National Marine Fisheries Service encourage Councils to identify Habitat Areas of Particular Concern (HAPCs) (50 CFR 600 Subpart J; 62 FR 66531; 67 FR 2343). HAPCs are subsets of EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. Designated HAPCs are not afforded any additional regulatory protection under the MSA; however, Federal projects with potential adverse impacts to HAPCs must be more carefully scrutinized.

This section has three basic objectives:

- First, it defines the EFH and HAPCs associated with the Atlantic trap/pot and anchored gillnet fisheries regulated by the ALWTRP.
- Second, it describes key components of lobster habitat in detail.
- Finally, it discusses how the ALWTRP can influence habitat, with a particular focus on potential disturbances to benthic habitat.

4.4.1 Identification of EFH

The 1996 re-authorization of the MSA requires that NMFS and the regional Fisheries Management Councils (Councils) specifically describe and identify EFH. In addition, the MSA requires that FMPs minimize, to the extent practicable, adverse effects on EFH caused by fishing activities. According to the EFH regulations found at 50 CFR 600, information necessary to identify EFH for each managed species includes its geographic range and habitat requirements by life stage; the distribution and characteristics of those habitats; and current and historic stock size as it affects occurrence in available habitats (50 CFR 600.815(a)(1)(ii)(A)). Information on the temporal and spatial distribution of each life history stage is needed to understand each species' relationship to, or dependence on, its various habitats.

Atlantic trap/pot and anchored gillnet fisheries are geographically widespread on the Atlantic coast and target a diverse array of fish and shellfish species. In the context of this EIS, EFH includes the habitat for all target species, non-target species, prohibited species, other species, and their prey. Therefore, when viewed in the aggregate, across all species, EFH is all pelagic and benthic habitat in the Atlantic EEZ.

4.4.2 Identification of HAPCs

The EFH regulations developed by NMFS encourage regional Fisheries Management Councils to identify Habitat Areas of Particular Concern (HAPCs) within areas designated as EFH. The intent of this action is to help focus conservation priorities on specific habitat areas that play a particularly important role in the life cycles of federally managed fish species (Dobrzynski and Johnson, 2001).

HAPCs are defined based on the following criteria:

- the importance of the ecological function provided by the habitat;
- the extent to which the habitat is sensitive to human-induced environmental degradation;
- whether and to what extent development activities are or will be stressing the habitat; and
- the rarity of the habitat type.

As the implementation of EFH regulations are subject to the discretion of the Councils, the designation of HAPCs has been approached in various ways. The following sections summarize the HAPCs designated by the Councils for EFH in the Atlantic EEZ, as described in "Regional Council Approaches to the Identification and Protection of Habitat Areas of Particular Concern" (Dobrzynski and Johnson, 2001).

4.4.2.1 New England Fishery Management Council (NEFMC) HAPCs

The NEFMC has designated discrete geographic areas as HAPCs for two of its managed species (NEFMC Amendments, 1998):

Atlantic Cod

For juvenile Atlantic cod, the NEFMC has designated a gravel/cobble bottom area on the northern edge of Georges Bank as an HAPC. This area meets the first criterion for an HAPC of providing an important ecological function, in that the gravel/cobble substrate provides a place for newly settled juvenile cod to find shelter from predation, helping to decrease typically high mortality rates associated with the juvenile life stage. In addition, these areas are typically rich in important prey items. This habitat also meets the second HAPC criterion of sensitivity to human-induces environmental degradation, in that it is vulnerable to fishing practices that use mobile fishing gear.

Atlantic Salmon

The NEFMC has designated eleven rivers in Maine as HAPCs for juvenile Atlantic salmon: the Dennys, Machias, East Machias, Pleasant, Narraguagus, Ducktrap, Kennebec, Penobscot. St. Croix, Tunk Stream, and Sheepscot Rivers provide habitat for the few remaining individuals of a distinct population segment of Atlantic salmon. These rivers are also extremely vulnerable to anthropogenic threats, thus fulfilling the first two criteria for designation of an HAPC, important ecological function, and sensitivity to human-induced environment degradation.

4.4.2.2 Mid-Atlantic Fishery Management Council (MAFMC) HAPCs

The MAFMC has designated HAPCs for summer flounder and tilefish. HAPCs have not been designated for other species under its jurisdiction due to a lack of information linking habitat type with recruitment success.

Summer Flounder

Submerged aquatic vegetation (SAV), defined as rooted, vascular, flowering plants that, except for some flowering structures, live and grow beneath the surface, has been identified as HAPCs for summer flounder. More specifically, this designation includes all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations used by adults and juveniles. These HAPCs meet the first criterion of an important ecological function, in that they provide both shelter from predators and sources of prey for the juvenile and larval-stages of this species in particular (MAFMC 1998).

Tilefish

Substrate between the 250- and 1200-foot isobaths, from the U.S./Canadian boundary to the Virginia/North Carolina boundary, within statistical areas 616 and 537 used by juvenile and adult tilefish has been designated as an HAPC for this species. In recent years, 90% of tilefish landings have occurred from these areas.

4.4.2.3. Atlantic Highly Migratory Species (HMS) HAPCs

Sandbar Sharks

HAPCs for Atlantic highly migratory species have been identified only for sandbar sharks. A general lack of information detailing HMS-habitat associations has prohibited the designation of HAPCs for other species in this management group. The Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (NMFS 1999) has identified HAPCs for sandbar sharks in important nursery and pupping grounds found in shallow areas and the mouth of the Great Bay, NJ; lower and middle Delaware Bay; lower Chesapeake Bay; and near the Outer Banks, NC in areas of Pamlico Sound adjacent to and offshore of Hatteras and Ocracoke Islands. This habitat fulfills the first HAPC criterion of providing an important ecological function.

4.4.2.4 South Atlantic Fishery Management Council (SAFMC) HAPCs

Unlike other Councils, the SAFMC has designated HAPCs for all of the species covered under a given fishery management plan (FMP), rather than for individual species. HAPCs have been designated broadly under their EFH Comprehensive Amendment (SAFMC, 1998), including both general habitat types, and specific areas of ecological importance identified in the appropriate FMP. HAPC criteria are not specified for individual habitats, but the designations are justified as enabling the Council to effectively protect EFH, and take timely actions to manage fisheries in HAPCs when needed. HAPCs have been designated by the SAMFC for species under the following FMPs:

Penaeid Shrimp

HAPCs for penaeid shrimp include all coastal inlets; all state-designated nursery habitats of particular importance to shrimp; and state-identified overwintering areas.

Red Drum

HAPCs identified for red drum include all state-designated nursery habitats of particular importance to red drum; documented sites of spawning aggregations in NC, SC, GA, and FL described in the Habitat Plan; other spawning areas identified in the future; and SAV-identified areas.

Snapper-Grouper Management Unit

For the fish species in the snapper-grouper management unit, the SAMFC has identified the following HAPCs: medium to high profile offshore hard bottoms where spawning normally occurs; areas of known or likely spawning aggregations; nearshore hard bottom area; the Point; the Ten Fathom Ledge; Big Rock; the Charleston Bump; mangrove habitat; seagrass habitat; oyster/shell habitat; all coastal inlets; all state-designated nursery habitats of particular importance to snapper/grouper; pelagic and benthic *Sargassum*; Hoyt Hills for wreckfish; the Oculina Bank Habitat Area of Particular Concern; all hermatypic (involved in reef formation) coral habitats and reefs; Manganese outcroppings on the Blake Plateau; and Council-designated Artificial Reef Special Management Zones (SMZs).

Coastal Migratory Pelagic Species

HAPCs for Southeast coastal migratory pelagic species include the sandy shoals of Cape Lookout, Cape Fear, and Cape Hatteras from the shore to the ends of the respective shoals; the Point; the Ten-Fathom Ledge; Big Rock; the Charleston Bump; Hurl Rocks; the Point off Jupiter Inlet; Worm reefs off the central east coast of Florida; nerashore hard bottom south of Cape Canaveral; the Hump off Islamorada, FL,; the Marathon Hump off Marathon, FL; The Wall off the Florida Keys; pelagic *Sargassum*; and Atlantic coast estuaries with abundant Spanish mackerel and cobia, including Bogue Sound, New River, and Broad River.

Spiny Lobster

For spiny lobster, the SAMFC has identified the following HAPCs: Florida Bay; Biscayne Bay; Card Sound; and all coral/hard bottom habitat from Jupiter Inlet, FL through the Dry Tortugas, FL.

The HAPCs designated by the SAMFC include a wide and varying range of habitats. Therefore, more detailed descriptions of some of the prominent HAPCs found in the Southeast region are provided below:

Charleston Bump and Gyre

The coastal region southeast of Charleston, South Carolina is known as the Charleston Bump. In this productive area, the depth of the seafloor rises abruptly from 700 to 300 meters within the short distance of about 20 kilometers. In the same area, the cyclonic Charleston Gyre is a permanent oceanographic feature of the South Atlantic Bight induced by the reflection of rapidly moving Gulf Stream waters. The Charleston Gyre is considered essential nursery habitat for some offshore reef fishes. It produces a large area of upwelling nutrients that contributes significantly to primary and secondary production, and is consequently important to some ichthyoplankton.

Ten Fathom Ledge and Big Rock

The Ten Fathom Ledge and Big Rock areas are located south of Cape Lookout, North Carolina. The Ten Fathom Ledge is located at 34° 11' N and 76° 07' W in 95 to 120 meter depth on the Continental Shelf in Onslow Bay, North Carolina. This area encompasses numerous patch reefs of coral-algal-sponge growth on rock outcroppings distributed over 136 square miles of ocean floor. The substrate consists of oolithic calcarenites and coquina forming a thin veneer over the underlying Yorktown formation of silty sands, clays, and calcareous quartz sandstones.

The Big Rock area encompasses 36 square miles of deep drowned reef around the 50 to 100 meter isobath on the outer shelf and upper slope approximately 36 miles south of Cape Lookout. Hard substrates at the Big Rock area are predominately algal limestone and calcareous sandstone.

Unique bottom topography at both sites produces oases of productive bottom relief with diverse and productive epifaunal and algal communities surrounded by a generally monotonous and relatively unproductive sand bottom. Approximately 150 species of reef-associated species have been documented at the two sites.

Shelf Break Area from North Carolina to Florida

The bottom area between 100 and 300 meters deep from Cape Hatteras to Cape Canaveral constitutes essential deep reef fish habitat. Series of troughs and terraces are composed of bioeroded limestone and carconate sandstone (Newton et al., 1971), and exhibit vertical relief ranging from less than half a meter to more than 10 meters. Ledge systems formed by rock outcrops and piles of irregularly sized boulders are common.

Overall, the deep reef fish community probably consists of fewer than 50 species. Parker and Ross (1986) observed 34 species of deepwater reef fishes (representing 17 families) from submersible operations off North Carolina in waters 98 to 152 meters deep.

Gray's Reef National Marine Sanctuary

Grays Reef National Marine Sanctuary is located 17.5 nautical miles east of Sapelo Island, Georgia, and 35 nautical miles Northeast of Brunswick, Georgia. Gray's Reef encompasses nearly 32 square kilometers at a depth of about 22 meters (Parker et al., 1994). The Sanctuary contains extensive but patchy hardbottoms of moderate relief (up to two meters). Rock outcrops, in the form of ledges, are often separated by wide expanses of sand, and are subject to weathering, shifting sediments, and slumping, which create a complex habitat including caves, burrows, troughs, and overhangs (Hunt, 1974). Parker et al. (1994) described the habitat preference of 66 species of reef fish distributed over five different habitat types. Numbers of species and fish densities were highest on the ledge habitat, intermediate on live bottom, and lowest over sand.

Nearshore Hard Bottom of Southeast Florida

The nearshore hard bottom areas extending semi-continuously from Cape Canaveral, FL ($28^{o}30'$ N) to at least Boca Raton, FL (26° 20' N) also meet the HAPC criteria. In terms of ecological function, several studies suggest that nearshore hard bottom reefs may serve as nursery habitat. Many species utilize these habitats during both newly settled and older juvenile life stages, suggesting that nearshore hard bottom can facilitate both inshore and offshore migrations during differing ontogenetic stages of some species. In southeast Florida waters, natural hard bottom areas with substantial three-dimensional structure are lacking. Absence of nursery structure can result in increased predation and lowered growth.

Corals and Coral Reefs

Coral is a living substrate that has been defined as a type of HAPC. Coral is a common name for a number of diverse invertebrate species within the phylum Coelenterata. The Alcyonarian soft corals are of interest because they can provide additional structure for habitat and have a potentially long life span. Soft corals can be bush or treelike in shape. Species found in this form attach to hard substrates such as rock outcrops or gravel. These species can range in size from a few millimeters to several meters, and the trunk diameter of large specimens can exceed 10 centimeters. Other Alcyonarians found in this region include sea pens and sea pansies (Order Pennatulacea), which are found in a wider range of substrate types. In their survey of Northeastern U.S. shelf macrobenthic invertebrates, Theroux and Wigley (1998) found Alcyonarians (including soft corals *Alcyonium sp*., *Acanella sp*., Paragorgia arborea, Primnoa reseda and sea pens) in limited numbers in waters deeper than 50 meters, and mostly at depths from 200 to 500 meters. Alcyonarians were present in each of the geographic areas identified in the study (Nova Scotia, Gulf of Maine, Southern New England Shelf, Georges Slope, Southern New England Slope) except Georges Bank. However, Paragorgia and Primnoa have been reported in the Northeast Peak region of Georges Bank (Theroux and Grosslein, 1987). Alcyonarians were most abundant by weight in the Gulf of Maine, and by number on the Southern New England Slope (Theroux and Wigley, 1998). Theroux and Wigley (1998) also found stony corals (*Astrangia danae* and *Flabellum sp*.) in the Northeast region, but they were uncommon. In similar work on the Mid-Atlantic shelf, the only Alcyonarians encountered were sea pens (Wigley and Theroux, 1981). The stony coral *Astrangia danae*, was also found, but its distribution and abundance were not discussed, and are assumed to be minimal.

Gorgonian corals are upright, hard coral species. They are colonies of animals composed of individual polyps, which deposit a tree or fanlike skeleton that supports the colony. In the Atlantic EEZ, gorgonian corals, particularly members of the genera Paragoria and Primnoa (red tree coral), may be especially valuable as fish habitat due to their longevity and large size (they can grow up to three meters high and seven meters wide). Some species of gorgonians may live to be over 100 years old (Risk et al., 1998; Andrews et al., 2002). Large Primnoa colonies may be hundreds of years old; a recent study using isotope dating concluded that a five-centimeter specimen of Primnoa reseda from Nova Scotia, Canada, was approximately 500 years old (Risk et al., 1998). The habitat created by these gorgonians may be occupied by communities with high biodiversity and may provide shelter for fish (Risk et al., 1998; Fossa et al., 1999). Given

their size and longevity, gorgonian corals may be especially vulnerable to fishing impacts and may take over 100 years to recover (Andrews et al., 2002). Although scientists have limited understanding of its importance as fish habitat, deep water coral clearly provides vertical structure for fish to use for protection and cover.

4.4.3 American Lobster Habitats

The American lobster fishery accounts for the majority of affected vessels and gear regulated by the ALWTRP. Because lobster habitat may be influenced by the proposed ALWTRP modifications, this section examines the unique aspects of lobster habitat in greater detail.

The American lobster (*Homarus americanus*) is distributed throughout the Northwest Atlantic Ocean from Newfoundland to Cape Hatteras, North Carolina. Juvenile and adult American lobsters occupy a wide variety of benthic habitats from the intertidal zone to depths of 700 meters. They are most abundant in relatively shallow coastal waters.

The following description of lobster habitats in the Northeast region of the U.S. (Maine to North Carolina) is based primarily on a report prepared by Lincoln (1998) from a variety of primary source documents. This information has been supplemented by the addition of some more recent research results. Exhibit 4-42 summarizes information on lobster densities by habitat type.

4.4.3.1 Inshore Lobster Habitats

Estuaries represent one key component of inshore lobster habitat, and encompass the following environments:

- **Mud Base with Burrows**: These habitats occur primarily in harbors and quiet estuaries with low currents. Lobster shelters are formed from excavations in soft substrate. This is an important habitat for juveniles and densities can be very high, reaching 20 animals per square meter.

- **Rock, Cobble and Gravel**: Juveniles and adolescents have been reported on shallow bottom with gravel and gravely sand substrates in the Great Bay Estuary, NH; on gravel/cobble substrates in outer Penobscot Bay, ME (Steneck and Wilson, 1998); and in rocky habitats in Narragansett Bay, RI (Lawton and Lavalli, 1985). Densities in Penobscot Bay exceeded 0.5 juveniles and 0.75 adolescents/m^2. According to unpublished information cited by Lincoln (1998), juvenile lobsters in Great Bay prefer shallow bottoms with gravely sand substrates.

- **Rock/Shell**: Adult lobsters in the Great Bay Estuary utilize sand and gravel habitats in the channels, but appear to prefer a rock/shell habitat

more characteristic of the high temperature, low salinity regimes of the central bay.

Inshore rock areas make up another important category of lobster habitat. These include the following:

- **Sand Base with Rock**: This is the most common inshore rock type in depths > 40 meters. It consists of sandy substrate overlain by flattened rocks, cobbles, and boulders. Lobsters are associated with abundant sponges, Jonah crabs, and rock crabs. Shelters are formed by excavating sand under a rock to form U-shaped, shallow tunnels. Densities of sub-adult lobsters are fairly high in these areas.

- **Boulders Overlaying Sand**: This habitat type is relatively rare in inshore New England waters. Compared to other inshore rocky habitats, lobster densities are low.

- **Cobbles**: Lobsters occupy shelters of varying size in the spaces between rocks, pebbles, and boulders. Densities as high as 16 lobsters/m^2 have been observed, making this the most densely populated inshore rock habitat for lobsters in New England.

- **Bedrock Base with Rock and Boulder Overlay**: This rock type is relatively common inshore, from low tide to depths of 15 to 45 meters. Shelters are formed by rock overhangs or crevices. Encrusting coralline algae and attached organisms such as anemones, sponges, and mollusks cover exposed surfaces. Green sea urchins and starfish are common. Cunner, tautog, sculpin, sea raven, and redfish are the most abundant fish. Lobster densities generally are low.

- **Mud-Shell/Rock Substrate**: This habitat type is usually found where sediment discharge is low and shells make up the majority of the bottom. It is best described off the Rhode Island coast. Lobster densities generally are low.

Other lobster habitat types are significant. For example, kelp beds represent another form of lobster habitat. Kelp beds in New England consist primarily of *Laminaria longicruris* and *L. saccharina*. Lobsters were attracted to transplanted kelp beds at a nearshore study site in the mid-coast region of Maine, reaching densities almost ten times higher than in nearby control areas (Bologna and Steneck, 1993). Lobsters did not burrow into the sediment, but sought shelter beneath the kelp. Only large kelp (> 50 cm in length) was observed sheltering lobsters and was used in the transplant experiments.

Lobster shelters also are formed from excavations cut into peat. Reefs form from blocks of salt marsh peat that break and fall into adjacent marsh creeks and channels and appear to

provide moderate protection for small lobsters from predators (Barshaw and Lavalli, 1988). Densities are high (up to 5.7/m^2) in these areas.

Lobsters have been associated with eelgrass beds in the lower portion of the Great Bay Estuary in New Hampshire (Short et al., 2001). Eighty percent of the lobsters collected from eelgrass beds were adolescents. Average density was 0.1/m^2, higher than reported by Barshaw and Lavalli (1988). In mesocosm experiments, Short et al. reported that lobsters showed a clear preference for eelgrass over bare mud. This research showed that adolescent lobsters burrow in eelgrass beds, utilize eelgrass as an overwintering habitat, and prefer eelgrass to bare mud.

Finally, research in Maine has demonstrated the presence of early settlement, postlarval, and juvenile lobsters in the lower intertidal zone (Cowan, 1999). Two distinct size classes were consistently present: three to 15 mm and 16 to 40 mm. Monthly mean densities during a five-year period ranged from zero to 8.6 individuals/m^2 at 0.4 meters below mean low water. Preliminary results indicate that areas of the lower intertidal zone serve as nursery grounds for juvenile lobster.

4.4.3.2 Offshore Lobster Habitats

Offshore areas supply several types of lobster habitat. First, more than 15 submarine canyons cut into the shelf edge on the south side of Georges Bank. These canyons were first surveyed in the 1930s, but were not fully explored until manned submersibles were used extensively in the 1980s. Detailed information on canyon habitats for American lobster are available primarily for Oceanographer Canyon, but is generally applicable to other major canyons on Georges Bank. Concentrations of adolescents and adult lobsters are substantially greater in submarine canyons than in nearby areas that are occupied mostly by adults (Cooper et al., 1987; Cooper and Uzmann, 1980). These canyons present a diverse group of habitat types:

- **Canyon Rim and Walls**: Sediments consist of sand or semi-consolidated silt with less than five percent overlay of gravel. The bottom is relatively featureless. Burrowing mud anemones are common but lobster densities are low.

- **Canyon Walls**: Sediments consist of gravely sand, sand, or semi-consolidated silt with more than five percent gravel. The bottom is relatively featureless. Burrowing mud anemones are common, as are Jonah crabs, ocean pout, starfish, rosefish, and squirrel hake. Lobster densities are somewhat higher than in substrates that contain less gravel (see above).

- **Rim and Head of Canyons at Base of Walls**: Sand or semi-consolidated silt substrate is overlain by siltstone outcrops and talus up to boulder size. The bottom is very rough and is eroded by animals and current scouring. Lobsters are associated with rock anemones, Jonah crabs, ocean pout,

tilefish, starfish, conger eels, and white hake. Densities are highly variable, but reach as high as 0.13 lobsters/m^2.

- **Pueblo Villages**: This habitat type exists in the clay canyon walls and extends from the heads of canyons to middle canyon walls. It is heavily burrowed and excavated. Slopes range from five to 70 degrees, but are generally between 20 and 50 degrees. Juvenile and adult lobsters and associated fauna create borings up to 1.5 meters in width, one meter in height, and two meters or more in depth. Lobsters are associated with Jonah crabs, tilefish, hermit crabs, ocean pout, starfish, and conger eels. This habitat may well contain the highest densities of lobsters found offshore.

In addition to canyons, lobster are associated with several other offshore habitat types, including the following:

- **Sand Base with Rocks**: Although common inshore (see above), this habitat is rather restricted in the offshore region except along the north flank of Georges Bank.

- **Clay Base with Burrows and Depressions**: This habitat is common on the outer continental shelf and slope. Lobsters excavate burrows up to 1.5 meters long. There are also large, bowl-like depressions that range in size from one to five meters in diameter and may shelter several lobsters at a time. Minimum densities of 0.001 lobsters/m^2 have been observed in summer.

- **Mud-Clay Base with Anemones**: This is a common habitat for lobsters on the outer shelf or upper slope. Forests of mud anemones (*Cerianthus borealis*) may reach densities of three or four per square meter. Depressions serve as shelter for relatively small lobsters at minimum densities of 0.001/m^2.

- **Mud Base with Burrows**: This habitat occurs offshore mainly in the deep basins, in depths up to 250 meters. This environment is extremely common offshore. Lobsters occupy this habitat, but no density estimates are available.

Exhibit 4-42

SUMMARY OF AMERICAN LOBSTER HABITATS AND DENSITIES

Habitat Category	Habitat Subtypes	Lobster Densities (number/ square meter)	Lobster Sizes	Source
ESTUARIES	Mud base with burrows	Up to 20	Small juveniles	Cooper and Uzmann, 1980
		< 0.01	Adults	Cooper and Uzmann, 1980
	Rock, cobble & gravel	> 0.5	Juveniles	Steneck and Wilson, 1998
		> 0.75	Adolescents	Steneck and Wilson, 1998
	Rock/shell	N.A.		
INSHORE ROCK TYPES	Sand base with rock	3.2	Avg. 40 mm carapace length	Cooper and Uzmann, 1980
	Boulders overlaying sand	0.09-0.13		Cooper and Uzmann, 1980
	Cobbles	Up to 16		Cooper and Uzmann, 1980
	Bedrock base with rock and boulder overlay	0.1-0.3		Cooper and Uzmann, 1980
	Mud-shell/rock substrate	0.15		Cooper and Uzmann, 1980
SUBMARINE CANYONS	Canyon rim and walls	0-0.0002	Adolescents and adults	Cooper et al., 1987
	Canyon walls	Up to 0.001	Adolescents and adults	Cooper et al., 1987
	Rim and head of canyons and at base of walls	0.0005-0.126	Adolescents and adults	Cooper et al., 1987
	Pueblo villages	0.0005-0.126	Adolescents and adults	Cooper et al., 1987
OTHER	Peat	Up to 5.7		Barshaw and Lavalli, 1988
	Kelp beds	1.2-1.68	Adolescents	Bologna and Steneck, 1993
	Eel grass	<0.04	Juveniles and adolescents	Barshaw and Lavalli, 1988
		0.1	80% adolescents	Short et al., 2001
	Sand base with rock	N.A.		
	Clay base with burrows and depressions	Minimum 0.001		Cooper and Uzmann, 1980
	Mud-clay base with anemones	Minimum 0.001	50-80 mm carapace length in depressions	Cooper and Uzmann, 1980

4.4.4 Impact of Fishing on EFH

The environmental impact analysis presented later in this EIS includes a discussion of how the ALWTRP may affect fishing gear and fishing practices, and subsequently influence marine habitat. Experts believe that fixed fishing gear (pots/traps and anchored gillnets) has a more direct impact on benthic habitat than on non-benthic (water column) habitat because it generally comes in contact with the sea floor. Therefore, the sections below review how fixed-gear fishing can affect habitat, with a primary focus on benthic habitat. The potential effects examined include:

- Alteration of physical structure;
- Mortality of benthic organisms;
- Changes to the benthic community and ecosystem;
- Sediment suspension;
- Chemical modifications; and
- Trap/pot loss and ghost fishing.

4.4.4.1 Alteration of Physical Structure

Any type of fishing gear that is towed, dragged, or dropped on the seabed will disturb the sediment and the resident community to varying degrees. Physical effects of fishing gear, such as ploughing, smoothing of sand ripples, removal of stones, and turning of boulders, can act to reduce the heterogeneity of the sediment surface. For example, boulder piles, crevices, and sand ripples can provide fish and invertebrates hiding areas and a respite from currents and tides. Removal of taxa, such as worm tubes, corals, and gorgonians that provide relief, and the removal or shredding of submerged vegetation, can also occur, thereby reducing the number of structures available to biota as habitat. The intensity of disturbance is dependent on the type of gear, sediment type, and frequency of disturbance.

Although there has been relatively little research conducted to document the impacts to physical structure from trap/pot gear, it is possible that benthic structures (both living and non-living) could be affected as traps/pots are dropped or dragged along the bottom. For example, Eno et al. (2001) observed and evaluated the effects of crab and lobster pots/traps on attached epibentic megafauna (sponges, bryozoans, ascidians, soft corals, and tube worms) at three locations in Great Britain, and conducted three experiments to assess sea pen recovery and survival following dragging, uprooting, and smothering by lobster pots/traps. Sea pens underneath traps/pots were bent over and some were even uprooted when traps/pots were dragged over mud sediments, but they fully recovered within 72 to 144 hours after pots/traps were removed. When traps/pots were dragged over the bottom, they left tracks, but four weeks of simulated commercial pot/trap fishing had no negative effects on the abundance of attached benthic epifauna. In fact, sponges increased in abundance in the experimental plots. Therefore, the study concluded that the use of pots/traps had no lasting effects on the three different habitat types observed.

4.4.4.2 Mortality of Benthic Organisms

In addition to effects on physical habitat, fishing gear can cause direct mortality to emergent epifauna. In particular, erect, foliose fauna or fauna that build reef-like structures have the potential to be destroyed by towed gear, longlines, or traps/pots (Hall, 1999). Physical structure of the biota sometimes determines their ability to withstand and recover from the physical impacts of fishing gear. For example, thinner shelled bi-valves and seastars often suffer higher damage than solid shelled bi-valves (Rumohr and Krost, 1991). Animals that can retract below the penetration depth of the fishing gear and those that are more elastic and can bend upon contact with the gear also fare much better than those that are hard and inflexible (Eno et al., 2001).

4.4.4.3 Changes to Benthic Communities and Ecosystems

The mortality of benthic organisms as a result of interaction with fishing gear can alter the structure of the benthic community, potentially causing a shift in the community from low-productive long-lived species (k-selected species) to highly-productive, short-lived, rapidly-colonizing species (r-selected species). For example, motile species that exhibit high fecundity and rapid generation times will recover more quickly from fishery-induced disturbances than non-mobile, slow-growing organisms, which may lead to a community shift in chronically fished areas (Levin, 1984).

Increased fishing pressure in a certain area may also lead to changes in species distribution. Changes (e.g., localized depletion) could be evident in benthic, demersal, and even pelagic species. Scientists have also speculated that mobile fishing may lead to increased populations of opportunistic feeders in chronically fished areas.

4.4.4.4 Sediment Suspension

Resuspension of sediment can occur as fishing gear is pulled or dragged along or immediately above the seafloor (NMFS, 2002c). Although resuspension of sediment is typically associated with mobile fishing gear, it also can occur with gear such as traps/pots.

Chronic suspension of sediments and resulting turbidity can affect aquatic habitat by reducing available light for photosynthesis, burying benthic biota, smothering spawning areas, and causing negative effects on feeding and metabolic rates. If it occurs over large areas, resuspension can redistribute sediments, which has implications for nutrient budgets (Messieh et al., 1991; Black and Parry, 1994; Mayer et al., 1991; and Pilskaln et al., 1998).

Species' reaction to turbidity depends on the particular life history characteristics of the organism. Effects are likely to be more significant in waters that are normally clear as compared to areas that typically experience high naturally induced turbidity (Kaiser, 2000). Mobile organisms can move out of the affected area and quickly return once the turbidity dissipates (Coen, 1995). Even if species experience high mortality within the affected area, those with high

levels of recruitment or high mobility can re-populate the affected area rapidly. However, sessile or slow-moving species would likely be buried and could experience high mortality. Furthermore, if effects are protracted and occur over a large area, recovery through recruitment or immigration will be hampered. Additionally, chronic resuspension of sediments may lead to shifts in species composition by favoring those species that are better suited to recover or those that can take advantage of the additional nutrient supply as the nutrients are released from the seafloor to the euphotic zone (Churchill, 1989).

4.4.4.5 Chemical Modifications

Disturbances associated with fishing gear also can cause changes in the chemical composition of the water column overlying affected sediments. In shallow water, the impacts may not be noticeable relative to the mixing effects caused by tidal surges, storm surges, and wave action. However, in deeper, calmer areas with more stable waters, the changes in chemistry may be more evident (NMFS, 2002c). Increases in ammonia content, decreases in oxygen, and pulses of phosphate have been observed in North Sea waters, although it is not clear how these changes affect fish populations. Increased incidence of phytoplankton blooms could occur during seasons when nutrients are typically low. The increase in primary productivity could have a positive effect on zooplankton communities and on organisms up the food chain.

Eutrophication, often considered a negative effect, could also occur. However, it is important to note that these releases of nutrients to the water act to recycle existing nutrients and, thereby, make them available to benthic organisms rather than add new nutrients to the system (ICES, 1992). This recycling is thought to be less influential in the eutrophication process than the input of new nutrients from rivers and land runoff.

4.4.4.6 Pot/Trap Loss and Ghost Fishing

Another potential problem associated with fixed gear is gear loss and subsequent “ghost fishing.” Lost lobster gear, for example, may continue to catch fish as long as it remains baited. The lost gear will not stop fishing until it is removed or made incapable of trapping or catching fish. Lost traps/pots may not only continue to fish, but may contribute considerable secondary habitat damage by becoming mobilized at times of storm activity and impacting delicate bottom communities.

The extent to which ghost fishing occurs, and its impacts on community structure have not been analyzed in detail. Most of the reports of injury and mortality of ghost pots/traps appear to be anecdotal. An early study noted that if traps/pots were lost, mortality of juvenile and forage species could decimate a fishing ground. The report suggested that considerable mortality could take place over the one to two years before the mesh corroded away, and indicated corrosion time would be longer and mortality would be greater for small sizes of mesh. A more recent study estimated the average fishing life of eight traps/pots observed off Key Biscayne,

Florida to be from 5.5 to 157 days before becoming unable to capture fish. While the decay and catch rates of ghost pots/traps are not well documented, at least some evidence indicates that lost traps/pots quickly become damaged and ineffective (Kelly, 1990).

4.5 REFERENCES

Agler, B.A., R.L. Schooley, S.E. Frohock, et al., Reproduction of Photographically Identified Fin Whales, *Balaenoptera physalus*, from the Gulf of Maine, *J. Mamm*. 74:577-587, 1993.

Andrews, A.H., E.E. Cordes, M.M. Mahoney, K. Munk, K.H. Coale, G.M. Cailliet, and J. Heifetz, Age, growth, and radiometric age validation of a deap-sea, habit-forming gorgonian (*Primnoa rasedaeformis*) from the Gulf of Alaska, *Hydrobiologia*, 471:101-110, 2002.

Atlantic States Marine Fisheries Commission, "American Lobster" viewed online at http://www.asmfc.org/Programs/Fish%20Mgnt/2002%20Factsheets%20PDF/American%20Lobster.pdf, August 19, 2003.

Atlantic States Marine Fisheries Commission (ASMFC), ASMFC Approves the Interstate Fishery Management Plan for Spiny Dogfish – Plan Implementation Slated for May 1, 2003, News Release, November 21, 2002.

Atlantic States Marine Fisheries Commission (ASMFC), Amendment 3 to the Interstate Fishery Management Plan for American Lobster, December 1997.

Auster, P.J. and R.W. Langton, The effects of fishing on fish habitat, in L. Benaka, ed. Fish habitat: essential fish habitat and rehabilitation, pp. 150-187, *Am. Fish. Soc., Symp*. 22, Bethesda, MD, 1999.

Barlow, J., and P. J. Clapham, A new birth-interval approach to demographic parameters of humpback whales, *Ecology*, 78: 535-546, 1997.

Barshaw, D.E. and K.L. Lavalli, Predation upon postlarval lobsters *Homarus americanus* by cunners *Tautogolabrus adspersus* and mud crabs *Neopanope sayi* on three different substrates: eelgrass, mud, and rock, *Mar. Ecol. Progr.*, Ser. 48: 119-123, 1988.

Bérubé, M., A. Aguilar, D. Dendanto, F. Larsen, G. Notarbartolo di Sciara, R. Sears, J. Sigurjónsson, J. Urban-Ramirez, and P.J. Palsbøll, Population genetic structure of North Atlantic and Mediterranean Sea fin whales, *Balaenoptera physalus* (Linnaeus 1758): analysis of mitochondrial and nuclear loci, and comparison to the Sea of Cortez fin whale population. *Molec. Ecol.* 15:585-599, 1998.

Best, P.B., Bannister, J.L., Brownell, R.L. Jr., and Donovan, G.P., (ed.), Report of the workshop on status and trends of western North Atlantic right whales. *J. Cetacean Res. Manage.* (Special Issue) 2: 61-87, 2001.

Bigelow, H.B. and W.C. Schroeder, Fishes of the Gulf of Maine, *Fishery Bulletin of the Fish and Wildlife Service*, Vol. 53, Contribution number 592, Woods Hole Oceanographic Institution, 1953.

Black, K.P. and G.D. Parry, "Sediment transport rates and sediment disturbance due to scallop dredging in Port Phillip Bay," *Mem. Queensl. Mus*., 36:327-341, 1994.

Blaylock, R.A., A pilot study to estimate abundance of the U.S. Atlantic coastal migratory bottlenose dolphin stock. NOAA Tech. Memo. NMFS-SEFSC-362, 9 pp. NMFS, Southeast Fisheries Science Center, Miami, FL, 1995.

Blaylock, R.A., J.W. Hain, L.J. Hansen, D.L. Palka, and G.T. Waring, U.S. Atlantic and Gulf of Mexico marine mammal stock assessments, NOAA Tech. Memo. NMFS-SEFSC-363. U.S. Department of Commerce, Washington, D.C., 1995.

Bologna, P.A. and R.S. Steneck, Kelp beds as habitat for American lobster *Homarus americanus*, *Mar. Ecol. Progr*., Ser. 100: 127-134, 1993.

Boulva, J. and I.A. McLaren, Biology of the harbor seal, *Phoca vitulina*, in eastern Canada, *Bull. Fish. Res. Bd. Can.* 200: 1-24, 1979.

Brown, M.B., O.C. Nichols, M.K. Marx, and J. N. Ciano, Surveillance of North Atlantic right whales in Cape Cod Bay and adjacent waters. Final report to the Division of Marine Fisheries, Commonwealth of Massachusetts. 29 pp., September 2002.

Carlson, J.K. and I. Baremore, The directed shark gillnet fishery: Non-right whale calving season 2002. SFD Contribution PCB-02-12, 2002a.

Carlson, J.K. and I. Baremore, The directed shark gillnet fishery: Right whale calving season 2002. SFD Contribution PCB-02-12, 2002b.

Caswell, H., M. Fujiwara, and S. Brault, Declining survival threatens the North Atlantic right whale. *Proc. Nat. Acad. Sci.* 96: 3308-3313, 1999.

Caulfield, R.A., Aboriginal subsistence whaling in Greenland: the case of Qeqertarsuaq municipality in West Greenland, *Arctic* 46:144-155, 1993.

CETAP, A characterization of marine mammals and turtles in the mid- and north Atlantic areas of the USA outer continental shelf. Cetacean and Turtle Assessment Program, University of Rhode Island. Final Report #AA551-CT8-48 to the Bureau of Land Management, Washington, DC, 538 pp., 1982.

Churchill, J.H., The effect of commercial trawling on sediment resuspension and transport over the Middle Atlantic Bight continental shelf, *Continental Shelf Research*, 9(9):841-864, 1989.

Clapham, P.J., Age at attainment of sexual maturity in humpback whales, *Megaptera novaengliae, Can. J. Zool.*, 70:1470-1472, 1992.

Clapham, P.J. and C.A. Mayo, Reproduction of humpback whales *(Megaptera novaengliae)* observed in the Gulf of Maine, *Rep. Int. Whal. Commn.* Special Issue 12: 171-175, 1990.

Clapham, P.J., L.S. Baraff, C.A. Carlson, M.A. Christian, et al., Seasonal Occurrence and Annual Return of Humpback Whales, *Megaptera novaeangliae,* In the Southern Gulf of Maine, *Can. J. Zool.,* 71: 440-443, 1993.

Clapham, P.J., S.B. Young, and R.L. Brownell, Baleen whales: Conservation issues and the status of the most endangered populations, *Marine Mammal Rev.* 29(1):35-60, 1999.

Clapham, P.J., S. Brault, H. Caswell, M. Fujiwara, S. Kraus, R. Pace, and P. Wade. Report of the working group on survival estimation for North Atlantic right whales. September 27, 2002.

Clarke, R., Open boat whaling in the Azores: the history and present methods of a relic history, *Discovery Rep.* 26:281-354, 1954.

Clark, C.W., Application of U.S. Navy underwater hydrophone arrays for scientific research on whales, *Reports of the International Whaling Commission* 45: 210-212, 1995.

Coen, L.D., A review of the potential impacts of mechanical harvesting on subtidal and intertidal shellfish resources, Unpublished Report, South Carolina Department of Natural Resources, Marine Resources Research Institute, 1995.

Collette, B.B. and MacPhee, G., eds., Bigelow and Schroeder's fishes of the Gulf of Maine, 3rd edition, Smithsonian Institution Press, Washington, D.C., 2002.

Committee for Whaling Statistics, International Whaling Statistics, 1959-1983.

Cooper, R.A. and J.R. Uzmann, Ecology of juvenile and adult *Homarus americanus*, pp. 97-142 in: *The Biology and Management of Lobsters* (J.S. Cobb and B.F. Phillips, eds.), Vol. II. Academic Press, N.Y., 1980.

Cooper, R.A., P. Valentine, J.R. Uzmann, and R.A. Slater, Submarine Canyons, pp. 53-63 in: *Georges Bank* (R.H. Backus, ed.), MIT Press, Cambridge, MA, 1987.

Cowan, D.F., Method for assessing relative abundance, size distribution, and growth of recently settled and early juvenile lobsters (*Homarus americanus*) in the lower intertidal zone. *J. Crust. Biol.,* 19(4): 738-751, 1999.

Dam, M. and D. Bloch, Screening of mercury and persistent organochlorine pollutants in long-finned pilot whale (*Globicephala melas*) in the Faroe Islands, *Marine Pollution Bulletin* 40: 1090-1099, 2000.

Dobrzynski, T., and Johnson, K., Regional Council Approaches to the Identification and Protection of Habitat Areas of Particular Concern, NMFS Office of Habitat Conservation, Silver Spring, MD, 16 pp., 2001.

Donovan, G.P., A Review of IWC Stock Boundaries, *Reports of the International Whaling Commission,* Special Issue 13: 39-68, 1991.

Doughty, R.W., Sea turtles in Texas: a forgotten commerce, *Southwestern Historical Quarterly* 88:43-70, 1984.

Ehrart, L.M., A survey of marine turtles nesting at Kennedy Space Center, Cape Canaveral Air Force Station, North Brevard County, Florida, unpublished report to the Div. of Mar. Fish. St Pete., FL, Flor. Dept. of Nat. Res., 1979.

Eno, N.C., D.S. MacDonald, J.A.M. Kinnear, S.C. Amos, C.J. Chapman, R.A. Clark, F.P.D. Bunker, and C. Munro, Effects of crustacean traps on benthic fauna. *ICES Journal of Marine Science*, 58:11-20, 2001.

Fisheries and Oceans Canada, Atlantic seal hunt: 2001 management plan, Available from Canadian Department of Fisheries and Oceans, Ottawa, Ontario Canada, K1A OE6, Resource Management – Atlantic, 2001.

Fisheries and Oceans Canada, Atlantic seal hunt: 2003-2005 management plan, Available from Canadian Department of Fisheries and Oceans, Ottawa, Ontario Canada, K1A OE6, Resource Management – Atlantic, 2003.

Fossa, J.H., D.M. Furevik, P.B. Mortensen, and M. Hovland, Effects of bottom trawling on Lophelia deep water coral reefs in Norway, Poster presented at ICES meeting on Ecosystem Effects of Fishing, March 1999.

Friedlaender, A.S., W.A. McLellan, and D.A. Pabst. Characterizing an interaction between coastal bottlenose dolphins (Tursiops truncatus) and the spot gillnet fishery in southeastern North Carolina, USA. *Journal of Cetacean Research and Management* 3(3):293-303, 2001.

Froese, R. and D. Pauly (eds.), 2003, FishBase, available online at www.fishbase.org, June 16, 2003 version.

Fujiwara, M. and H. Caswell, Demography of the endangered North Atlantic right whale, *Nature* 414: 537-541, 2001.

Gambell, R., International management of whales and whaling: a review of the regulation of commercial and aboriginal subsistence whaling, *Arctic* 46:97-107, 1993.

Garrison, L.P., Mortality estimate for Atlantic bottlenose dolphin in the directed shark gillnet fishery of Florida and Georgia. NMFS/SEFSC report prepared for the Bottlenose Dolphin Take Reduction Team. NMFS, Southeast Fisheries Science Center, Miami, FL 33149. 2001.

Garrison, L.P., Protected species interactions with the directed shark gillnet fishery off Florida and Georgia from 1999-2002. NMFS/SEFSC internal report. Available from: Southeast Fisheries Science Center, 75 Virginia Beach Dr., Miami, FL 33149. 2003.

Garrison, L.P., P.E. Rose, A. Hohn, R. Raird, and W. Hoggard, Abundance of the coastal morphotype of bottlenose dolphin, *Tursiops truncatus*, in U.S. continental shelf waters between New Jersey and Florida during winter and summer 2002. NMFS/SEFSC report prepared for the Bottlenose Dolphin Take Reduction Team, NMFS, Southeast Fisheries Science Center, Miami, FL 33149. 2002.

Geraci, J.R., Clinical investigation of the 1987-88 mass mortality of bottlenose dolphins along the U.S. central and south Atlantic coast, Final Report to the National Marine Fisheries Service, U.S. Navy, Office of Naval Research, and Marine Mammal Commission, Washington, D.C., 1989.

Gilbert, J.R. and N. Guldager, Status of harbor and gray seal populations in northern New England, Final Report to NMFS, NEFSC, Woods Hole, MA, Coop. Agree. 14-16-009-1557, 13 pp., 1998.

Gilbert, J.R., and K.M. Wynne, Harbor seal populations and fisheries interactions with marine mammals in New England, Interim report, NOAA NA-84-EAC-00070, NMFS, NEFSC, Woods Hole, MA,15 pp., 1985.

Gilbert, J.R., and K.M. Wynne, Marine mammal interactions with New England gillnet fisheries, Final Report Contract No. NA-84-EAC-00070, NMFS, NEFSC, Woods Hole, MA, 21 pp., 1987.

Goodyear, J.D., Significance of Feeding Habitats of North Atlantic Right Whales Based on Studies of Diel Behaviour, Diving, Food Ingestion Rates, and Prey, A thesis presented to the Faculty of Graduate Studies of the University of Guelph in partial fulfillment of requirements for the degree of Doctor of Philosophy, 1996.

Gulf of Mexico Fishery Management Council (GMFMC) and South Atlantic Fishery Management Council (SAFMC). Fishery Management Plan, Final Environmental Impact Statement, Regulatory Review. Final Regulations for the Coastal Migratory Pelagic Resources (Mackerels). Gulf of Mexico Fishery Management Council, Lincoln Ctr., Suite 881, 5401 West Kennedy Blvd., Tampa, FL, South Atlantic Fishery Management Council, 1 Southpark Circle, Suite 306, Charleston, SC, 1983.

Hain, J.H.W., M.J. Ratnaswamy, R.D. Kenney, and H.E. Winn, "The fin whale, *Balaenoptera physalus*, in waters of the northeastern United States continental shelf," *Reports of the International Whaling Commission* 42: 653-669, 1992.

Hall, S.J., The effects of fishing on marine ecosystems and communities, Blackwell Science, Oxford, 274 pp., 1999.

Hamilton, P.K., and C.A. Mayo, Population characteristics of right whales *(Eubalaena glacialis)* observed in Cape Cod and Massachusetts Bays, 1978-1986, *Reports of the International Whaling Commission,* Special Issue No. 12: 203-208, 1990.

Hamilton, P.K., M.K. Marx, and S.D. Kraus, Scarification analysis of North Atlantic right whales *(Eubalaena glacialis)* as a method of assessing human impacts. Final report to the Northeast Fisheries Science Center, NMFS, Contract No. 4EANF-6-0004, 1998.

Hartley, D., A. Whittingham, J. Kenney, T. Cole, and E. Pomfret. Large Whale Entanglement Report 2001. Report to the National Marine Fisheries Service, updated February 2003. 61 pp. 2003.

Haycock, C.R. and S.N. Mercer, Observations and notes on the abundance and distribution of cetaceans in the Eastern Bay of Fundy near Brier Island, Nova Scotia, in August and September 1984, Unpublished report, 1984.

Henwood, T.A., and W. Stuntz, Analysis of sea turtle captures and mortalities during commercial shrimp trawling, *Fishery Bulletin*, U.S. 85(4):813-817, 1987.

Hoese, H.D., and R.H. Moore, Fishes of the Gulf of Mexico, Texas, Louisiana, and adjacent waters. Texas A & M Press. 327 pp., 1977.

Holsbeek, L., C.R. Joiris, V. Debacker, I.B. Ali, P. Roose, J-P. Nellissen, S. Gobert, J-M. Bouquegneau, and M. Bossicart, Heavy metals, organochlorines, and polycyclic aromatic hydrocarbons in sperm whales stranded in the southern North Sea during the 1994/1995 winter, *Marine Pollution Bulletin*, 38(4):304-313, 1999.

Hunt, J.L., Jr., The geology of Gray's Reef, Georgia continental shelf, M.S. thesis, Univ. Georgia, Athens, 83 pp., 1974.

ICES, Report of the Study Group on Ecosystem Effects of Fishing Activities, Copenhagen, 7-14 April, 1992, International Council for the Exploration of the Sea, Study Group on Ecosystem Effects of Fishing Activities, ICES CM 1992/G:11, 144 pp., 1992.

International Whaling Commission (IWC), Report of the Special Meeting on Sperm Whale Biology and Stock Assessments, *Reports of the International Whaling Commission,* 21:40-50, 1971.

International Whaling Commission (IWC), Right whales: past and present status, *Reports of the International Whaling Commission*, Special Issue No. 10; Cambridge, England, 1986.

International Whaling Commission (IWC), Report of the comprehensive assessment special meeting on North Atlantic fin whales. *Reports of the International Whaling Commission* 42: 595-644, 1992.

Johnson, A., G. Salvador, J. Kenney, J. Robbins, S. Kraus, S. Landry, and P. Clapham, Fishing gear involved in entanglements of right and humpback whales, *Marine Mammal Science* (in press), 2005.

Johnston, D.W., P. Meisenheimer, and D.M. Lavigne, An evaluation of management objectives for Canada's commercial harp seal hunt, 1996-1998, *Cons. Biol.* 14: 729-737, 2000.

Kaiser, M.J., The implications of the effects of fishing on non-target species and habitats, pp. 383-392, in M.J. Kaiser and S.J. de Groot, *The Effects of Fishing on Non-target Species and Habitats*, Blackwell Science, 2000.

Katona, S.K., J.A. Beard, Population Size, Migrations, and Feeding Aggregations of the Humpback Whale *(Megaptera novaeangliae)* in the Western North Atlantic Ocean, *Reports of the International Whaling Commission*, Special Issue 12: 295-306, 1990.

Katona, S. K., V. Rough and D. T. Richardson, A field guide to whales, porpoises, and seals from Cape Cod to Newfoundland, *Smithsonian Institution Press*: Washington, DC, 316 pp, 1993.

Kelly, G.H., A review of fish trapping, a non-thesis paper submitted in partial fulfillment of the requirements of the degree of Master of Science in Ocean Science, Nova Southeastern University, 61 pp., 1990.

Kenney, R.D., Are right whales starving? Electronic newsletter of the Center for Coastal Studies, posted at www.coastalstudies.org/entanglementupdate/kenney1.html on November 29, 2000.

Kenney, R.D., North Atlantic, North Pacific, and Southern hemisphere right whales, pp. 806-813 in: W. F. Perrin, B. Wursig, and J.G.M. Thewissen (eds.), *Encyclopedia of Marine Mammals*. Academic Press, CA. 2002.

Kenney, R.D., M.A.M. Hyman, R.E. Owen, G.P. Scott, and H.E. Winn, Estimation of prey densities required by Western North Atlantic right whales, *Mar. Mamm. Sci.* 2(1): 1-13, 1986.

Knowlton, A. R., J. Sigurjonsson, J.N. Ciano, and S.D. Kraus, Long-distance movements of North Atlantic right whales *(Eubalaena glacialis)*, *Mar. Mamm. Sci.* 8(4): 397-405, 1992.

Knowlton, A.R. and S.D. Kraus, "Mortality and serious injury of northern right whales *(Eubalaena glacialis)* in the western North Atlantic Ocean," *J. Cetacean Res. Manage.*, 2001.

Knowlton, A.R., M.K. Marx, H.M. Pettis, P.K. Hamilton, and S.D. Kraus. Analysis of scarring on North Atlantic right whales *(Eubalaena glacialis)*: monitoring rates of entanglement interaction. Final contract report to the National Marine Fisheries Service. 18 pp. October 2003.

Kraus, S.D., Rates and Potential Causes of Mortality in North Atlantic Right Whales *(Eubalaena glacialis)*, *Mar. Mamm. Sci.* 6(4):278-291, 1990.

Kraus, S.D., M.J. Crone, and A.R. Knowlton. The North Atlantic right whale, in: W.E. Chandler (ed.), *The Audubon Wildlife Report 1988/1989*. Academic Press, N.Y. 1988.

Kraus, S.D., P.K. Hamilton, R.D. Kenney, A.R. Knowlton, and C.K. Slay. Reproductive parameters of the North Atlantic right whale. *J. Cetacean Res. Manage*. (Special Issue) 2: 231-236. 2001.

Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet, M. Podesta, Collisions between ships and whales, *Marine Mammal Science* 17(1):35- 75, 2001.

Laviguer, L. and M. O. Hammill, Distribution and seasonal movements of grey seals, *Halichoerus grypus*, born in the Gulf of St. Lawrence and eastern Nova Scotia shore, *Can. Field-Nat*., 107: 329-340, 1993.

Lawton, P. and K.L. Lavalli, Postlarval, juvenile, adolescent, and adult ecology, pp. 47-88 in: Biology of the Lobster *Homarus americanus* (J.R. Factor, ed.), Academic Press, NY, 1985.

Leatherwood, S., and R.R. Reeves, *The Sierra Club handbook of whales and dolphins*, Sierra Club Books, San Francisco, California, 1983.

Levin, L.A., Life history and dispersal patterns in a dense infaunal polychaete assemblage: community structure and response to disturbance, *Ecology*, 65(4):1185-1200, 1984.

Lincoln, D., Lobsters on the edge-essential lobster habitats in New England, Report prepared for Greenlite Consultants, Newton Highlands, MA, 1998.

Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz, Human impacts on sea turtle survival, pp. 387-409, in: P.L. Lutz and J.A. Musick, (eds.), *The Biology of Sea Turtles*, CRC Press, Boca Raton, FL, 432 pp., 1997.

Malik, S., M. W. Brown, S.D. Kraus, and B. N. White, Analysis of DNA diversity within and between North and South Atlantic right whales, *Mar. Mammal Sci.* 16:545-558, 2000.

Mansfield, A.W, The grey seal in eastern Canadian waters, *Can. Audubon Mag*., 28:161-166, 1966.

Manzella, S. A., C. W. Caillouet, Jr. and C. T. Fontaine, Kemp's ridley sea turtle, *Lepidochelys kempi*, head-start tag recoveries: distribution, habitat and method of recovery, *Mar. Fish. Rev*. 50(3):24-32, 1988.

Marquez, R., Status report of the Kemp's ridley turtle, in Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (eds.), Proceedings of the 2nd Western Atlantic Turtle Symposium, NOAA Technical Memorandum NMFS-SEFC-226, 1989.

Martin, A.R., G.P. Donovan, S. Leatherwood, et al., *Whales and Dolphins*, Bedford Editions Ltd., London, pp. 192, 1990.

Mate, B.M., S.L. Nieukirk, and S.D. Kraus, Satellite-monitored movements of the North Atlantic right whale, *J. Wildl. Manage.*, 61:1393-1405, 1997.

Mayer, L.M., D.F. Schick, R.H. Findlay, and D.L. Rice, Effects of commercial dragging on sedimentary organic matter, *Mar. Environ. Res.* 31: 249-261, 1991.

Mayo, C. and M. Marx, Surface Foraging Behaviour of the North Atlantic Right Whale, *Eubalaena glacialis*, and Associated Zooplankton Characteristics, *Canadian Journal of Zoology*, 68: 2214-2220, 1990.

Messieh, S.N., T.W. Rowel, D.L. Peer, and P.J. Cranford, The effects of trawling, dredging and ocean dumping on the eastern Canadian continental shelf seabed, *Continental Shelf Research*, 11(8-10):1237-1263, 1991.

Meylan, A., B. Schroeder, and A. Mosier, Sea turtle nesting activity in the state of Florida, *Fla. Mar. Res. Publ.* 52:1-51, 1995.

Mid-Atlantic Fishery Management Council (MAFMC), Amendment 12 to the Summer Flounder, Scup, Black Sea Bass Fishery Management Plan, Dover: MAFMC, 1998.

Mid-Atlantic Fishery Management Council (MAFMC), 2003 Proposed and Final Federal Commercial Management Measures, 2003.

Mitchell, E., Present status of the northwest Atlantic fin and other whale stocks, pp. 108-169 in W.E. Schevill (ed.) *The whale problem: a status report*. Harvard University Press, Cambridge, Massachusetts, 1974.

Mitchell, E.D., Winter Records of the Minke Whale *(Balaenoptera acutorostrata* Lacepede 1804) in the Southern North Atlantic, *Rep. Int. Whal. Commn.*, 41: 455-457, 1991.

Mitchell, E. and D.G. Chapman, Preliminary assessment of stocks of northwest Atlantic sei whales (*Balaenoptera borealis*), *Rep. Int. Whal. Comm*. Special Edition 1:117-120, 1977.

Mizroch, S.A. and A.E. York, "Have pregnancy rates of Southern Hemisphere fin whales, *Balaenoptera physalus*, increased?" *Reports of the International Whaling Commission*, Special Issue No. 6:401-410, 1984.

Muir, D.C.G., R. Wagemann, N.P. Grift, R.J. Norstrom, M. Simon, and J. Lien, Organochlorine Chemical and Heavy-Metal Contaminants in White-Beaked Dolphins (*Lagenorhynchus albirostris*) and Pilot Whales (*Globicephala melaena*) from the Coast of Newfoundland, Canada, *Archives of Environmental Contamination and Toxicology*, 17(5): 613-629, September 1988.

Murphy, M., South Atlantic Fishery Management Council, Charleston, SC, personal communication to Jennifer Kassakian, Industrial Economics, Inc., Cambridge, MA, September 16, 2003.

Murphy, Margaret A., Occurrence and group characteristics of minke whales, *Balaenoptera acutorostrata*, in Massachusetts Bay and Cape Cod Bay, *Fishery Bulletin*, 93: 577-585, 1995.

Musick, J.A. and C.J. Limpus, Habitat utilization and migration in juvenile sea turtles, pp 137-164 in: Lutz, P.L. and J.A. Musick, eds., *The Biology of Sea Turtles*. CRC Press, New York, 432 pp., 1997.

National Research Council (NRC), *Decline of the sea turtles: Causes and prevention*, National Academy Press, Washington, D.C., 1990.

New England Fishery Management Council (NEFMC), Final Amendment 11 to the Northeast Multispecies Fishery Management Plan, Amendment 9 to the Atlantic Sea Scallop Fishery Management Council, Amendment 1 to the Monkfish Fishery Management Plan, Components of the Proposed Atlantic Herring Fishery Management Plan for Essential Fish Habitat: Incorporating the Environmental Assessment, Newburyport: NEFMC, 1998.

New England Fishery Management Council (NEFMC), Fishery Management Plan for Deep-Sea Red Crab, March 2002.

New England Fishery Management Council (NEFMC), "Frequently Asked Questions about the Groundfish Fishery," as viewed online at http://www.nefmc.org/faqs/gf_facts.PDF on June 20, 2003a.

New England Fishery Management Council (NEFMC), Final Amendment 13 to the Northeast Multispecies Fishery Management Plan, Newburyport, Massachusetts, December 2003b.

New England Fishery Management Council (NEFMC), "Species Managed by the NEFMC," as viewed online at http://www.nefmc.org/overview/text_species.htm on June 19, 2003c.

Newton, J.G., O.H. Pilkey, and J.O. Blanton, An oceanographic atlas of the Carolina and continental margin, North Carolina Dept. of Conservation and Development, Raleigh, 57 pp., 1971.

Nielsen, J. B., F. Nielsen, P-J. Jørgensen, and P. Grandjean, Toxic metals and selenium in blood from pilot whales (*Globicephala melas*) and sperm whales (*Physeter catodon*), *Mar. Pollut. Bull*., 40:348-351, 2000.

NMFS, Final recovery plan for the North Atlantic right whale *(Eubalaena glacialis)*, Prepared by the Right Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland, 1991a.

NMFS, Final recovery plan for the humpback whale (*Megaptera novaeangliae)*, Office of Protected Resources, November 1991b.

NMFS, Harvesting the Value-added Potential of Atlantic Hagfish, April 1996.

NMFS, Draft recovery plans for the fin whale (*Balaenoptera physalus*) and sei whale (*Balaenoptera borealis*), Prepared by R.R. Reeves, G.K. Silber, and P.M. Payne for the National Marine Fisheries Service, Silver Spring, Maryland, July 1998a.

NMFS, Recovery plan for the blue whale (*Balaenoptera musculus*), Prepared by R.R. Reeves, P.J. Clapham, and R.L. Brownell, Jr. for the National Marine Fisheries Service, Silver Spring, Maryland, 1998b.

NMFS, Final Fishery Management Plan for Altantic Tunas, Swordfish, and Sharks, Vol. II, Washington, DC: NMFS, 1999.

NMFS, Draft Large Whale Entanglement Summary 1997-2001, October 2001.

NMFS, Stock structure of coastal bottlenose dolphins along the Atlantic coast of the U.S. NMFS/SEFSC Report prepared and reviewed for the Bottlenose Dolphin Take Reduction Team. Available from NMFS-Southeast Fisheries Science Center, 75 Virginia Beach Drive, Miami, FL 33149, 2001a.

NMFS, Reinitiation of Consultation on the Federal Lobster Management Plan in the Exclusive Economic Zone, Biological Opinion, Consultation No. F/NER/2001/00651, Northeast Region Protected Resources Division, June 2001b.

NMFS, Small Entity Compliance Guide, October 10, 2002a.

NMFS in conjunction with the Maine Department of Marine Resources. EA for a Jonah Crab Experimental Fishery in EEZ Nearshore (Lobster) Management Area 1, May 2002b.

NMFS, Restricted Access Management Program (RAM), The IFQ Program: Report to the Fleet, February, 2002c.

NMFS, Northeast Dealer Weighout Database, Coastal Fisheries Logbook Program, Sustainable Fisheries Division, Southeast Fisheries Science Center, Miami, FL, 2002d.

NMFS, Southeast Logbook Database, Coastal Fisheries Logbook Program, Sustainable Fisheries Division, Southeast Fisheries Science Center, Miami, FL, 2002e.

NMFS, Summary of Selected Federal Trap/Pot and Gillnet Fisheries managed by Fishery Management Plans developed in accordance with the Magnuson-Stevens Act and/or the Atlantic Coastal Fisheries Cooperative Management Act. Unpublished report of the Protected Resources Division, Northeast Regional Office, National Marine Fisheries Service, Gloucester, MA, 2003a.

NMFS-Northeast Fisheries Science Center, "Status of Fisheries Resources off Northeastern United States-Scup," viewed on-line at http://www.nefsc.noaa.gov/sos/spsyn/og/scup/ on 8/14/2003b.

NMFS-Northeast Fisheries Science Center, "Status of Fisheries Resources off Northeastern United States-Black Sea Bass," viewed on-line at http://www.nefsc.noaa.gov/sos/spsyn/og/seabass/ on 8/14/03c.

NMFS, Annual Commercial Landing Statistics. Available at: http://www.st.nmfs.gov/st1/commercial/landings/annual_ landings.html, August 14, 2003d.

NMFS, Sea Turtle Conservation Measures for the Pound Net Fishery in Virginia Waters of the Chesapeake Bay, Biological Opinion, Consultation No. F/NER/2003/01596, Northeast Region Protected Resources Division, 2004a.

NMFS, Northeast Region, Sustainable Fisheries Division, 2004b.

NMFS and U.S. Fish and Wildlife Service, Guide to the Listing of a Distinct Population Segment of Atlantic Salmon as Endangered, November 2000.

North Atlantic Marine Mammal Commission, Report of the NAMMCO Scientific Committee Working Group on Management Procedures, in: NAMMCO Annual Report, NAMMCO, Tromso, Norway, pp. 117-131, 1998.

Northeast Fisheries Science Center, 30th Stock assessment workshop report, Woods Hole, MA, April 2000, NMFS-NEFSC, Ref Doc 00-03, 2000.

Palka, Debra, Summary of the PBR and Bycatch for the Coastal Bottlenose Dolphin. Northeast Fisheries Science Center, NOAA Fisheries. Bottlenose Dolphin Take Reduction Process Document Inventory Number: 4-01-03 p., March 20, 2003.

Palka, Debra and Marjorie Rossman, Effects of Alternative Mitigation Measures on Mortality of Coastal Bottlenose Dolphins in Gillnet Fisheries. Northeast Fisheries Science Center, NOAA Fisheries. Bottlenose Dolphin Take Reduction Process Document Inventory Number: 4-1-03 p., March 11, 2003.

Palka, D. and M. Rossman, Effects of Alternative Mitigation Measures on Mortality of Coastal Bottlenose Dolphins in Gillnet Fisheries. Northeast Fisheries Science Center, NOAA Fisheries. Unpublished Data. February 4, 2004. 43 pp. 2004.

Palka, D., A. Read and C. Potter, Summary of knowledge of white-sided dolphins (*Lagenorhynchus acutus*) from the U.S. and Canadian North Atlantic waters, *Rep. Int Whal. Comm.*, 47: 729-734, 1997.

Palsboll, P.J., J. Allen, M. Berube, et al., Genetic Tagging of Humpback Whales, *Nature*, 388: 767-769, 1997.

Parker, R.O., Jr., and S.W. Ross, Observing reef fishes from submersibles off North Carolina, *Northeast Gulf Sci*., 8:31-49, 1986.

Parker, R.O., Jr., A.J. Chester, and R.S. Nelson, A video transect method for estimating reef fish abundance, composition, and habitat utilization at Gray's Reef National Marine Sanctuary, Georgia, *Fish. Bull*., 92:787-799, 1994.

Payne, P.M., D.N. Wiley, S.B. Young, S. Pittman, P.J. Clapham, and J.W. Jossi, Recent fluctuations in the abundance of baleen whales in the southern Gulf of Maine, *Fish. Bull*. 88 (4): 687-696, 1990.

Payne, P.M., J.R. Nicholas, L. O'Brien, and K.D. Powers, The Distribution of the Humpback Whale, *Megaptera novaeangliae*, on Georges Bank and in the Gulf of Maine in Relation to Densities of the Sand Eel, *Ammodytes americanus, Fish. Bull., U.S.* 84: 271-277, 1986.

Perrin, W.F., B. Wursig, and J.G.M. Thewissen, Encyclopedia of Marine Mammals, Academic Press: San Diego, 2002.

Perry, S.L., D.P. DeMaster, and G.K. Silber, The great whales: and status of six species listed as endangered under the U.S. Endangered Species Act of 1973, *Mar. Fish. Rev*. Special Edition. 61(1): 59-74, 1999.

Pettis, H.M., R.M. Rolland, P.K. Hamilton, S. Brault, A.R. Knowlton, and S.D. Kraus. Visual health assessment of North Atlantic right whales (*Eubalaena glacialis*) using photographs. *Can. J. Zool*. 82: 8-19. 2004.

Pike, B. The North Atlantic right whale catalog: an update on mortality, reproduction and population status, in: North Atlantic Right Whale Consortium Annual Meeting Abstracts. New Bedford Whaling Museum, November 4-5, 2003. New England Aquarium compilers. 2003.

Pilskaln, C.H., J.H. Churchill, and L.M. Mayer, Resuspension of sediment by bottom trawling in the Gulf of Maine and potential geochemical consequences, *Conserv. Biol.* 12: 1223-1229, 1998.

Reeves, R., R. Rolland, and P.J. Clapham, Causes of Reproductive Failure in North Atlantic Right Whales: New Avenues of Research, Report of a Workshop Held 26-28 April 2000, Falmouth, Massachusetts, Northeast Fisheries Science Center, Reference Document 01-016, 2001.

Reeves, R., R. and Mitchell, E., History of whaling in and near North Carolina. NOAA Tech. Rep. NMFS 65: 28pp., 1988.

Risk, M.J., D.E. McAllister, and L. Behnken, 1998, Conservation of cold- and warm-water seafans: Threatened ancient gorgonian groves, *Sea Wind*, 10(4):20-22, in National Marine Fisheries Service, 2001.

Robbins, J. and D. Mattila. Monitoring entanglement scars on the caudal peduncle of Gulf of Maine humpback whales. Report to the National Marine Fisheries Service. Order No. 40EANF80028. 15 pp., 1999.

Robbins, J. and D.K. Mattila, Gulf of Maine Humpback Whale Entanglement Scar Monitoring Results, 1997-1999, Final report to the U.S. National Marine Fisheries Service (unpublished), available from the Center for Coastal Studies, Box 1036, Provincetown MA 02657, 2000.

Rough, V., Gray seals in Nantucket Sound, Massachusetts, winter and spring, 1994, Final report to Marine Mammal Commission, Contract T10155615, 28 pp. NTIS Pub. PB95-191391, 1995.

Rumohr, H., and P. Krost, Experimental evidence of damage to benthos by bottom trawling with special reference to *Arctica islandica*, *Meeresforschung*, 33(4):340-345, 1991.

Sainsbury, J., Commercial Fishing Methods: An Introduction to Vessels and Gears, Surrey: London, 1971.

Schaeff, C.M., S.D. Kraus, M.W. Brown, J.S. Perkins, R. Payne, and B.N. White, Comparison of genetic variability of North and South Atlantic right whales *(Eubalaena)* using DNA fingerprinting, *Can. J. Zool.* 75:1073-1080, 1997.

Schevill, W.E., W.A. Watkins, and K.E. Moore, Status of *glacialis* off Cape Cod, *Reports of the International Whaling Commission*, Special Issue No. 10: 79-82, 1986.

Scott, G.P., D. M. Burn, and L.J. Hansen, The dolphin die off: long term effects and recovery of the population. Proceedings: Oceans '88, IEEE Cat. No. 88-CH2585, Vol. 3: 819-823, 1988.

Sears, R., F.W. Wenzel, and J.M. Williamson, Behavior and distribution observations of Cetacea along the Quebec north shore (Mingan Islands), summer-fall 1981, Unpublished report, Mingan Island Cetacean Study, Montreal, 72 pp., 1981.

Seipt, I., P.J. Clapham, C.A. Mayo, and M.P. Hawvermale, Population characteristics of individually identified fin whales, *Balaenoptera physalus*, in Massachusetts Bay, *Fish. Bull*. 88:271-278, 1990.

Serchuk, F.M. and R.L. Wigley, Deep-sea red crab, *Geryon quinquedens*, in: M.D. Grosslein and T.R. Azarovitz (eds.), Fish distribution. MESA New York Bight Atlas Monograph 15. NY Sea Grant Institute, Albany, NY, 1982.

Short, F.T., K. Matso, H.M. Hoven, J. Whitten, D.M. Burdick, and C.A. Short, Lobster use of eelgrass habitat in the Piscataqua River on the New Hampshire/Maine border, USA, *Estuaries* 24(2): 277-284, 2001.

Sigurjonsson, J., On the Life History and Autecology of North Atlantic Rorquals, in: A.S. Blix, L. Walloe, and O. Ulltang (eds), *Whales, Seals, Fish and Man*, Elsevier Science, pp. 425-441, 1995.

South Atlantic Fishery Management Council (SAFMC), Final Comprehensive Amendment Addressing Essential Fish Habitat in the Fishery Management Plans of the South Atlantic Region: Amendment 3 to the Shrimp Fishery Management Plan; Amendment 1 to the Red Drum Fishery Management Plan; Amendment 10 to the Snapper Grouper Fishery Management Plan; Amendment 10 to the Coastal Migratory Pelagics Fishery Management Plan; Amendment 1 to the Golden Crab Fishery Management Plan; and Amendment 4 to the Coral, Coral reefs, and Live/Hard Bottom Habitat Fishery Management Plan (Including Final ES/SEIS, RIR, & SIA/FIS), Charleston, SAFMC, 1998.

South Atlantic Fishery Management Council (SAFMC), Report of Black Sea Bass Stock Assessment Workshop, Beaufort, NC, February 14, 2003.

Southeast Fisheries Science Center (SEFSC), Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic, U.S. Department of Commerce, National Marine Fisheries Service, Miami, Florida, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-V1, 2001.

Steneck, R.S. and C. Wilson, Why are there so many lobsters in Penobscot Bay?, pp. 72-75 in: *Rim of the Gulf – Restoring Estuaries in the Gulf of Maine* (D.D. Platt, ed.), The Island Institute, Rockland, ME, 1998.

Stevick, P.T., J. Allen, P.J. Clapham, N. Friday, S.K. Katona, F. Larsen, J. Lien, D.K. Mattila, P.J. Palsbøll, R. Sears, J. Sigurjónsson, T.D. Smith, G. Vikingsson, J. Øien, and P.S. Hammond, Trends in abundance of North Atlantic humpback whales, 1979-1993, Paper SC/53/NAH2 presented to the International Whaling Commission Scientific Committee, Available from IWC, 135 Station Road, Impington, Cambridge, UK, 2001.

Stevick, P., N. Oien and D.K. Mattila. Migration of a humpback whale between Norway and the West Indies. *Mar. Mammal Sci.* 14: 162-166, 1998.

Swingle, W.M., S.G. Barco, T.D. Pitchford, W.A. McLellan, and D.A. Pabst, Appearance of juvenile humpback whales feeding in the nearshore waters of Virginia, *Mar. Mamm. Sci.* 9: 309-315, 1993.

Taruski, A. G., C. E. Olney and H. E. Winn, Chlorinated hydrocarbons in cetaceans, *J. Fish. Res. Bd. Can*. 32(11): 2205-9, 1975.

Theroux, R.B. and M.D. Grosslein, Benthic fauna, in R.H. Backus and D.W. Bourne, eds., *Georges Bank*, pp. 283-295, MIT Press, Cambridge, MA, 1987.

Theroux, R.B. and R.L. Wigley, Quantitative composition and distribution of the macrobenthic invertebrate fauna of the continental shelf ecosystems of the northeastern United States, NOAA Tech. Rep., NMFS 140, 240 pp., 1998.

Turtle Expert Working Group, Assessment Update for the Kemp's Ridley and Loggerhead Sea Turtle Populations in the Western North Atlantic, U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-SEFSC-444, 2000.

U.S. Fish and Wildlife Service, Economic Assessment of the Atlantic Coast Horseshoe Crab Fishery, April 7, 2000.

Volgenau, L. and S. Kraus, The Impact of Entanglements on Two Substocks of the Western North Atlantic Humpback Whale, *Megaptera novaeangliae*, report submitted to NOAA/NMFS Marine Entanglement Research Program, Contract # 43ABNF002563, 1990.

Wade, P. R., and R. P. Angliss, Guidelines for assessing marine mammal stocks: Report of the GAMMS Workshop, April 3-5, 1996, Seattle, Washington. NOAA Technical Memorandum NMFS-OPR-12. U.S. Dept. of Commerce, Washington, DC. 93 pp., 1997.

Ward, Nathalie, Stellwagen Bank: A Guide to the Whales, Sea Birds, and Marine Life of the Stellwagen Bank National Marine Sanctuary, pp. 157-158, Down East Books, Camden, ME, 1995.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano, Sperm whales associated with Gulf Stream features off the northeastern USA shelf. Fish. Oceanogr. 2(2):101-105, 1993.

Waring, G.T., J.M. Quintal, S.L. Swartz (eds.), U.S. Atlantic and Gulf of Mexico marine mammal stock assessments – 2000, NOAA Technical Memorandum NMFS-NE-168, 2000.

Waring, G.T., J.M. Quintal, and C.P. Fairfield (eds.), U.S. Atlantic and Gulf of Mexico marine mammal stock assessments - 2002, NOAA Technical Memorandum NOAA Fisheries-NE-169, 2002.

Waring, G.T., R.M. Pace, J.M. Quintal, C.P. Fairfield, and K. Maze-Foley (eds.), U.S. Atlantic and Gulf of Mexico marine mammal stock assessments – 2003, NOAA Technical Memorandum NOAA-NE-182, 2003.

Watkins, W.A., and W.E. Schevill, Aerial observation of feeding behavior in four baleen whales: *Eubalaena glacialis, Balaenoptera borealis, Megaptera novaeangliae*, and *Balaenoptera physalus, J. Mamm*. 60: 155- 163, 1979.

Watkins, W.A., and W.E. Schevill, Observations of right whales *(Eubalaena glacialis)* in Cape Cod waters, *Fish. Bull.* 80(4): 875-880, 1982.

Weisbrod, A.V., D. Shea, M.J. Moore, and J.J. Stegeman, Organochlorine exposure and bioaccumulation in the endangered Northwest Atlantic right whale *(Eubalaena glacialis)* population, *Environmental Toxicology and Chemistry*, 19(3):654-666, 2000a.

Weisbrod, A. V., D. Shea, M. J. Moore, and J. J. Stegeman, Bioaccumulation patterns of polychlorinated biphenyls and chlorinated pesticides in northwest Atlantic pilot whales, *Environ. Toxicol. Chem.,* 19:667-677, 2000b.

Whittingham, A., D. Hartley, J. Kenney, T. Cole, and E. Pomfret. Large Whale Entanglement Report. Report to the National Marine Fisheries Service, updated April 2003. 44 pp. 2003.

Whittingham, A., D. Hartley, and J. Kenney (in draft). Large Whale Entanglement Report. Report to the National Marine Fisheries Service, 49 pp., updated January 2004.

Wigley, R.L. and R.B. Theroux, "Atlantic continental shelf and slope of the United States – macrobenthic invertebrate fauna of the middle Atlantic bight region – faunal composition and quantitative distribution," Geol. Surv. Prof. Pap. 529-N, 198 pp., 1981.

Wiley, D.N., R.A. Asmutis, T.D. Pitchford, and D.P. Gannon, "Stranding and mortality of humpback whales, *Megaptera novaengliae*, in the Mid-Atlantic and southeast United States, 1985-1992," *Fish. Bull.*, U.S. 93:196-205, 1995.

Wilson, C., Maine State Department of Marine Resources, West Boothbay Harbor, ME, personal communication to Jennifer Kassakian, Industrial Economics, Inc., Cambridge MA, September 24, 2003.

Winn, H.E., C.A. Price, and P.W. Sorensen, The distribution of the right whale *(Eubalaena glacialis)* in the western North Atlantic, *Reports of the International Whaling Commission*, Special Issue No. 10:129-138, 1986.

Witherington, B., Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, St. Petersburg, FL, personal communication to Barbara Shroeder, National Marine Fisheries Service, Protected Resources Division, Silver Spring, MD, and Dennis Klemm, National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, FL, April 24, 2004.

Wynne, K. and M. Schwartz, Guide to marine mammals and turtles of the U.S. Atlantic and Gulf of Mexico, Rhode Island Sea Grant, Narragansett, 115 pp., 1999.

Appendix 4-A

SPECIES LANDED WITH TRAP/POT GEAR IN 2002

Exhibit 4A-1

TOTAL LANDINGS CAUGHT WITH TRAP/POT GEAR IN 2002[1]

Region	Species	Pounds Landed[2]
Northeast (ME to VA)	LOBSTER	79,507,800
	CRAB, BLUE	51,210,987
	CRAB, NK	13,986,496
	CRAB, RED	4,781,419
	HAGFISH	2,999,949
	CRAB, JONAH	2,605,026
	CATFISH	2,233,433
	CONCHS	1,975,610
	WHELK, CHANNELED	1,600,248
	SEA BASS, BLACK	1,428,309
	CRAB, ROCK	1,105,396
	EEL, AMERICAN	551,262
	SCUP	548,981
	WHELK, KNOBBED	159,928
	PERCH, WHITE	144,086
	CROAKER, ATLANTIC	105,833
	CRAB, GREEN	86,397
	EEL, CONGER	83,501
	TAUTOG	67,611
	TURTLE, SNAPPER	51,996
	BULLHEADS	50,939
	TOADFISH, OYSTER	49,343
	SHRIMP (PANDALID)	40,984
	OTHER FISH	39,965
	PUFFER, NORTHERN	32,021
	FLOUNDER, SUMMER	28,523
	PERCH, YELLOW	23,475
	CUNNER	22,737
	MENHADEN	17,981
	CUSK	16,371
	BLUEFISH	15,851
	SQUID (LOLIGO)	14,997
	HAKE, RED	12,750
	COD	11,907
	ANGLER	10,663
	SHAD, AMERICAN	8,904
	WEAKFISH, SQUETEAGUE	8,755
	BASS, STRIPED	6,178
	TRIGGERFISH	6,089
	OCTOPUS	5,673
	POUT, OCEAN	5,047
	HAKE, WHITE	4,796
	CRAB, HORSESHOE	4,482
	SPOT	4,453
	SKATES	4,328
	SEA RAVEN	3,964

Exhibit 4A-1

TOTAL LANDINGS CAUGHT WITH TRAP/POT GEAR IN 2002[1]

Region	Species	Pounds Landed[2]
	CARP	2,936
	TUNA, YELLOWFIN	2,223
	SHARK, NK	2,200
	MACKEREL, ATLANTIC	1,847
	MUMMICHOG	1,599
	HERRING, ATLANTIC	1,338
	DOGFISH SMOOTH	1,336
	MACKEREL, SPANISH	1,259
	WOLFFISHES	1,243
	CRAB, JAPANESE SHORE	1,230
	FLOUNDER, WINTER	1,205
	DOGFISH SPINY	1,190
	SWORDFISH	930
	EEL, NK	670
	HAKE, SILVER	606
	HADDOCK	478
	BUTTERFISH	476
	TUNA, LITTLE	432
	BONITO	252
	COBIA	209
	GIZZARD SHAD	102
	POLLOCK	100
	CRAB, HERMIT	100
	HALIBUT, ATLANTIC	88
	DOLPHIN FISH	88
	SHARK, LARGE COASTAL	86
	SHRIMP (MANTIS)	59
	RN GRENADIER	50
	TILEFISH	46
	DRUM, BLACK	45
	TUNA NK	45
	FLOUNDER, SAND-DAB	45
	PERIWINKLES	42
	DRUM, RED	42
	SHARK, BLACK TIP	40
	SHARK, THRESHER	35
	MULLETS	32
	HOGFISH	31
	SEA ROBINS	28
	OTHER SHELLFISH	25
	SPADEFISH	16
	WEAKFISH, SPOTTED	15
	FLOUNDER, YELLOWTAIL	14
	MACKEREL, KING	13
	FLOUNDER, WITCH	10

Exhibit 4A-1

TOTAL LANDINGS CAUGHT WITH TRAP/POT GEAR IN 2002[1]

Region	Species	Pounds Landed[2]
	WHITING, KING	8
	SHRIMP (PENAEID)	8
	AMBER JACK	8
	HAKE MIX RED & WHITE	7
	PIGFISH	5
	CREVALLE	4
	FLOUNDER, AM. PLAICE	3
	CRAPPIE	2
Southeast (NC to FL)	SEA BASS,ATLANTIC,BLACK,UNC	401,597
	GRUNT,WHITE	20,502
	PINFISH,SPOTTAIL	10,609
	OCTOPUS	10,162
	GRUNTS	7,319
	LOBSTER,SPINY	6,149
	TRIGGERFISH,GRAY	3,172
	BLUE RUNNER	1,971
	SNAPPER,VERMILION	1,734
	GRUNT,SAILORS CHOICE	1,700
	SPANISH MACKEREL	1,592
	PORGY,JOLTHEAD	1,272
	EEL,CONGER	1,232
	GROUPER,RED	898
	EELS,UNC	801
	SNAPPER,MANGROVE	705
	SNAPPER,MUTTON	678
	MACKEREL,KING AND CERO	544
	MARGATE	458
	TILEFISH,BLUELINE	433
	GROUPER,GAG	415
	PORGY,WHITEBONE	279
	GROUPER,BLACK	263
	BLUEFISH	257
	HOGFISH	197
	PORGY,RED,UNC	183
	HAKE,ATLANTIC,RED & WHITE	64
	DOLPHINFISH	61
	TUNA,ALBACORE	60
	FINFISHES,UNC FOR FOOD	58
	TRIGGERFISH,OCEAN	58
	PORGY,KNOBBED	56
	SNAPPER,RED	47
	SEA BASS,ROCK	42
	CRAB,STONE (UNC CLAWS)	41
	SNAPPER,YELLOWTAIL	33
	TUNA,BLACKFIN	24
	GRUNT,FRENCH	22
	SNAPPER,SILK	16
	FLOUNDER,ATLANTIC & GULF,UNC	11
	SCUPS OR PORGIES,UNC	9

Exhibit 4A-1

TOTAL LANDINGS CAUGHT WITH TRAP/POT GEAR IN 2002[1]

Region	Species	Pounds Landed[2]
	SAND PERCH	9
	COD,ATLANTIC,UNC	7
	PUFFERS	5
	HIND,RED	4
	GROUPER,SNOWY	2
	PIGFISH	2
	MARGATE,BLACK	2
	BANDED RUDDERFISH	1

Sources:
NMFS, 2002d.
NMFS, 2002e.

Notes:
1 Potentially affected gillnet fisheries include Atlantic croaker, spot, striped bass, bluefish, skate, and weakfish. Catch of these species by ALWTRP affected gear types is relatively small; therefore, NMFS did not include an Exhibit to demonstrate total landings caught with gillnet gear in 2002. See Section 4.2.13 (Other Affected Fisheries) for further clarification.
2 The landings figures represent total pounds landed with trap/pot gear and include landings from coastal waters that are exempt from ALWTRP regulations. Southeast landings do not include landings by state-permitted-only vessels.

Appendix 4-B

NORTHEAST MULTISPECIES FISHERY COMPLEX: SPECIES INFORMATION

Exhibit 4B-1

NAME, DISTRIBUTION, BIOLOGY AND COMMERCIAL USES OF SPECIES COMPRISING THE NORTHEAST MULTISPECIES FISHERY COMPLEX

Photo ID	Common name	Scientific name	Distribution in western Atlantic	Biology	Maximum weight; age	Commercial uses
1	American plaice	*Hippoglossoides platessoides*	Southern Labrador in Canada and western Greenland to Rhode Island in U.S.	Lives on soft bottoms. Feeds on invertebrates and small fishes.	6.4 kg; 30 years	Marketed fresh and frozen.
2	Atlantic cod	*Gadus morhua*	Ungava Bay to Cape Hatteras along the North American coast.	Oceanic, this species is widely distributed in a variety of habitats from the shoreline to well down the continental shelf. Omnivorous, the cod feeds at dawn or dusk on invertebrates and fish, including young cod. Forms schools during the day. Spawns once a year.	96 kg; 25 years	Marketed fresh, dried/salted, smoked and frozen.
3	Atlantic halibut	*Hippoglossus hippoglossus*	Southwestern Greenland and Labrador in Canada to Virginia in the U.S.	Benthic but occasionally caught pelagically. Feeds mainly on other fishes (cod, haddock, pogge, sand-eels, herring, capelin), but also takes cephalopods, large crustaceans and other bottom-living animals. Growth rate varies according to density, competition and availability of food. Slow growth rate and late onset of sexual maturity.	320 kg; 50 years	Utilized fresh/dried/salted, smoked and frozen.
4	Haddock	*Melanogrammus aeglefinus*	From Strait of Belle Isle to Cape May, New Jersey.	Feeds mainly on small bottom-living organisms including crustaceans, molluscs, echinoderms, worms and fishes.	16.8 kg; 20 years	Sold fresh, chilled as fillets, frozen, smoked and canned. Also utilized for fish meal and animal feeds.
5	Ocean pout	*Macrozoarces americanus*	Labrador in Canada to Delaware in U.S. (rarely to Virginia; doubtfully to North Carolina).	Occurs from intertidal zone to more than 180 m depth.	5.4 kg; NA	NA

Exhibit 4B-1

NAME, DISTRIBUTION, BIOLOGY AND COMMERCIAL USES OF SPECIES COMPRISING THE NORTHEAST MULTISPECIES FISHERY COMPLEX

Photo ID	Common name	Scientific name	Distribution in western Atlantic	Biology	Maximum weight; age	Commercial uses
6	Offshore hake	*Merluccius albidus*	Georges Bank, New England to Surinam and French Guiana.	An offshore species that inhabits the outer part of the continental shelf and upper part of the slope. Feeds at night, when it comes up towards the surface. Food consists primarily of fishes (particularly lantern fishes, sardines and anchovies) and, to a lesser extent, crustaceans and squid.	4.1 kg; NA	Marketed fresh, frozen, and smoked.
7	Pollock	*Pollachius virens*	Southern Nova Scotia, straying to the Gulf of St. Lawrence, to North Carolina.	An active, gregarious fish occurring in inshore and offshore waters. Usually enters coastal waters in spring and returns to deeper waters in winter. Smaller fish in inshore waters feed on small crustaceans (copepods, amphipods, euphausiids) and small fish, while larger fish prey predominantly upon fishes. Migrations for spawning are known to occur. Also long-distance north-south migrations for Europe and the U.S.	32 kg; 25 years	Utilized fresh, dried/salted, smoked, canned and frozen.
8	Red hake	*Urophycis chuss*	From North Carolina to southern Nova Scotia, straying to the Gulf of St. Lawrence.	Found on soft muddy and sandy bottoms, but never on rocks, gravel or shells. Juveniles live along the coasts at shallow depths (4-6 m); adults migrate to deeper waters, generally to between 110 and 130 m, and in some instances, to over 550 m. Juveniles live in scallops (*Placopecten magellanicus*) and remain close to scallop beds until they mature. Feed on shrimp, amphipods and other crustaceans, also on squid and herring, flatfish, mackerel and others.	3.6 kg; NA	Utilized fresh, dried/salted and frozen; small fish are also used for fishmeal.
9	Redfish	*Sebastes faciatus*	Iceland to New Jersey.	Inhabits deep water. Bears live young. Gregarious throughout life. Feeds on euphausiids, decapods, mysids, small molluscs and fishes. Ovoviviparous.	NA; NA	NA

Exhibit 4B-1

NAME, DISTRIBUTION, BIOLOGY AND COMMERCIAL USES OF SPECIES COMPRISING THE NORTHEAST MULTISPECIES FISHERY COMPLEX

Photo ID	Common name	Scientific name	Distribution in western Atlantic	Biology	Maximum weight; age	Commercial uses
10	White hake	*Urophycis tenuis*	Labrador and the Grand Banks of Newfoundland to the coast of North Carolina. Straying to Iceland in the east and Florida in the south.	Found on soft, muddy bottoms of the continental shelf and upper slope. It is mostly found at 180 m. Mature fish migrate inshore in the northern Gulf of Maine in summer, disperse in autumn, and move into deepest areas in winter. Feeds on small crustaceans, squid and small fish.	21 kg; 10 years	Utilized fresh, smoked or frozen.
11	Whiting	*Merluccius bilinearis*	Coast of Canada and U.S. from Belle Isle Channel to the Bahamas; most common from southern Newfoundland to South Carolina.	Abundant on sandy grounds and strays into shallower waters. A voracious predator with cannibalistic habits. Individuals over 40 cm TL prey on fishes such as gadoids and herring, while smaller ones feed on crustaceans, i.e. euphausiids and pandalids. Exhibits seasonal onshore-offshore migration.	2.3 kg; 12 years	Marketed fresh, smoked and frozen; fresh fish are exported to European markets.
12	Windowpane flounder	*Scophthalmus aquosus*	Gulf of St. Lawrence in Canada to northern Florida in U.S.	Occurs from shore to 45 m depth, occasionally in deeper water.	NA; NA	NA
13	Winter flounder	*Pseudopleuronectes americanus*	Labrador in Canada to Georgia in U.S.	Feed predominantly in daytime on organisms living in, on or near the bottom; shrimp, amphipods, crabs, sea urchins and snails.	3.6 kg; NA	Marketed fresh or frozen.
14	Witch flounder	*Glyptocephalus cynoglossus*	Gulf of St. Lawrence and Grand Banks in Canada to North Carolina in U.S.	Inhabits soft mud bottoms in fairly deep water. Feeds on crustaceans, polychaetes and brittle stars.	2.5 kg; 25 years	Marketed fresh or frozen.
15	Yellowtail flounder	*Pleuronectes ferruginea*	Southern Labrador in Canada to Chesapeake Bay in U.S.	Inhabits sandy to muddy bottoms. Prefers depths of 37 to 82 m at temperatures of 3-5°C. Feeds mainly on polychaete worms and amphipods, shrimp, isopods and other crustaceans, and occasionally on small fish such as sand lance and capelin.	1.5 kg; 12 years	Marketed fresh or frozen.

Sources: NMFS, 2004b. List of species taken from NEFMC, 2003c. Species information taken from Froese, R. and D. Pauly (eds.), 2003, and Collette and MacPhee, 2002.

Exhibit 4B-2

IMAGES, NORTHEAST MULTISPECIES FISHERY COMPLEX

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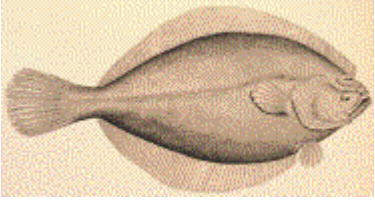

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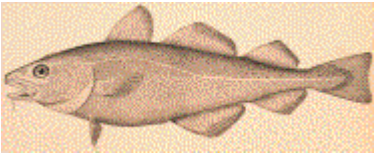

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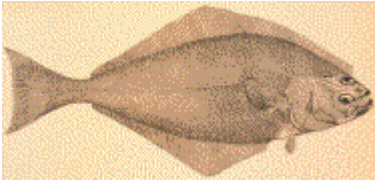

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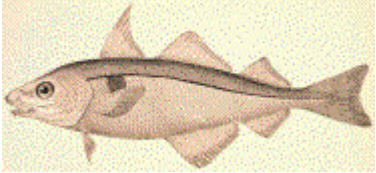

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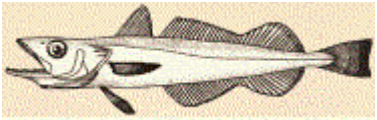

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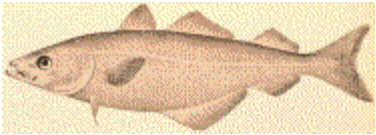

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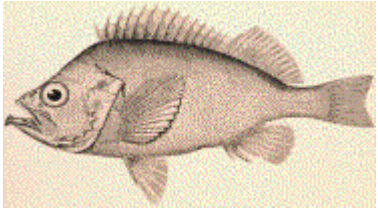

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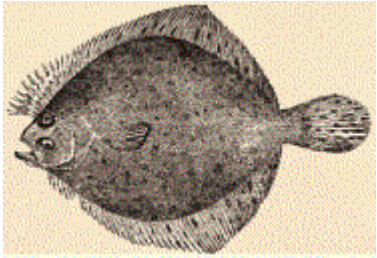

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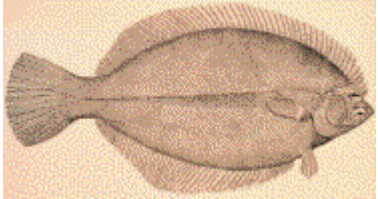

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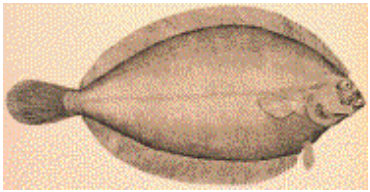

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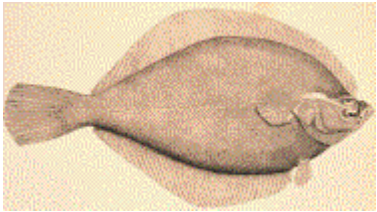
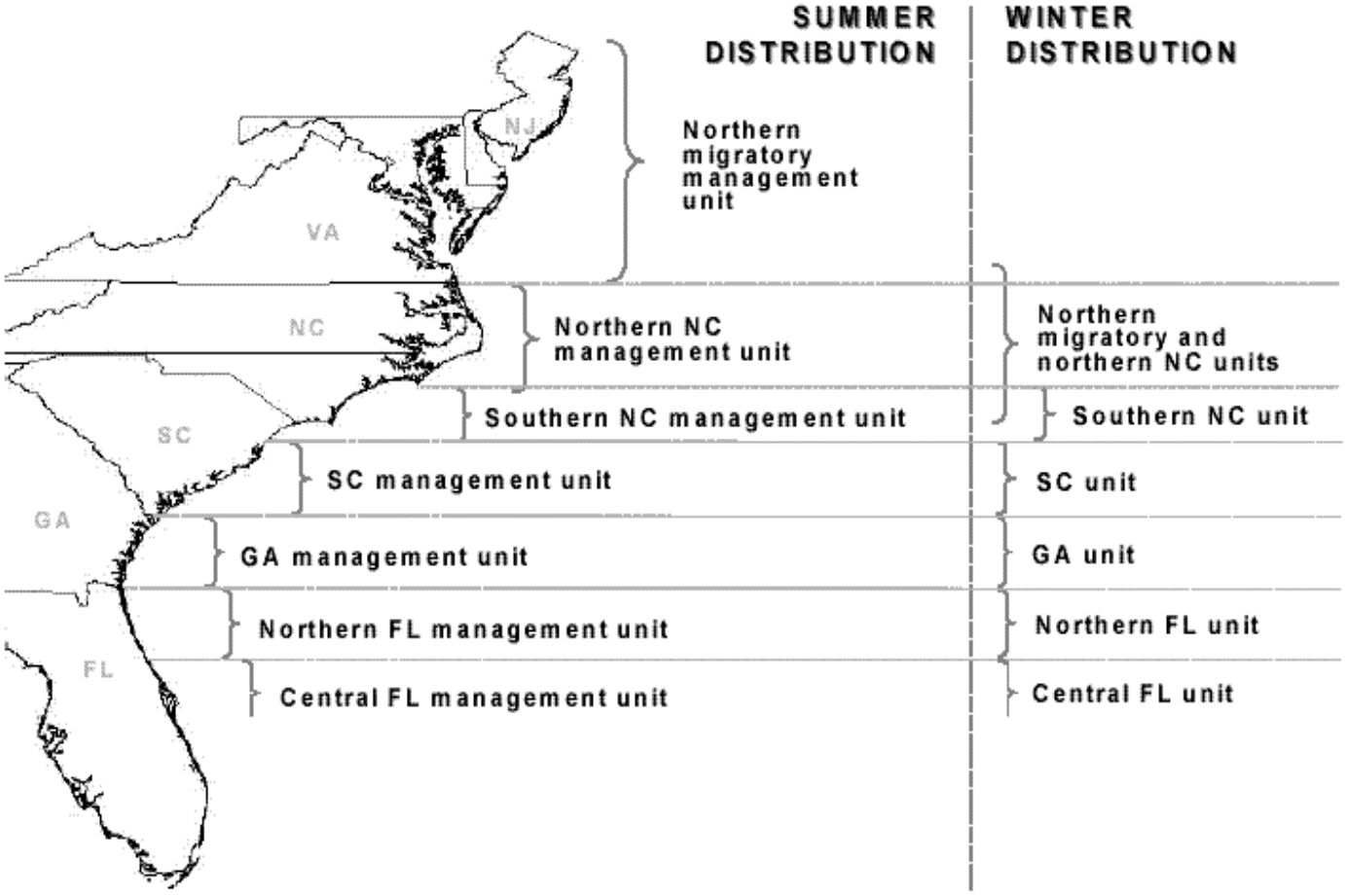


Source: NEFMC, 2003c.

Appendix 4-C

MANAGEMENT UNITS FOR THE WESTERN NORTH ALANTIC COASTAL BOTTLENOSE DOLPHIN

Appendix 4C-1

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