ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Action Agency: National Marine Fisheries Service, Northeast Fisheries Science Center

Activity: Endangered Species Act Section 7 Consultation on the Proposed Award of Research Set-Aside for the Spring and Fall 2009 Surveys of the NEAMAP Near Shore Trawl Program [Consultation No. F/NER/2008/08795]

Consulting Agency: National Marine Fisheries Service, Northeast Region, through its Protected Resources Division

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Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), requires that each Federal agency shall insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a Federal agency may affect species listed as endangered or threatened under the ESA, that agency is required to consult with either the NOAA Fisheries Service (NMFS) or U.S. Fish and Wildlife Service (FWS), depending upon the species that may be affected. In instances where NMFS or FWS are themselves authorizing, funding, or carrying out an action that may affect listed species, the agency must conduct intra-service consultation. Since the action described in this document is proposed to be funded by the NMFS Northeast Fisheries Science Center (NEFSC), this office has requested formal intra-service section 7 consultation.

NMFS NEFSC proposes to provide funding in the form of pounds of summer flounder, scup, black sea bass, bluefish, and *Loligo* squid to the Virginia Institute of Marine Science (VIMS) under the 2009 Mid-Atlantic Research Set-Aside (RSA) Program for the Spring and Fall 2009 surveys to be conducted as part of the Northeast Area Monitoring and Assessment Program (NEAMAP) Near Shore Trawl Program (RSA Project 09-MID-02). These surveys require the use of bottom trawl gear in areas and at times when sea turtles are also likely to be present. The NMFS Northeast Regional Office (NERO) has, therefore, initiated formal intra-service consultation with NMFS NEFSC in accordance with section 7(a)(2) of the ESA given that the use of bottom trawl gear for the Spring and Fall 2009 surveys may adversely affect loggerhead sea turtles as a result of capture in the gear. This document represents NMFS's biological opinion (Opinion) on the proposed project, and its effects on ESA-listed species under NMFS jurisdiction in accordance with section 7 of the ESA.

Formal intra-service section 7 consultation on the Spring and Fall 2009 NEAMAP surveys was initiated by NMFS NERO on December 23, 2008 [Consultation No. F/NER/2008/08795]. This Opinion is based on information provided in VIMS's Environmental Assessment (EA) for the NEAMAP Near Shore Trawl Program 2009 (VIMS 2008), NMFS's recent biological opinion on the Fall 2008 NEAMAP surveys (NMFS 2008), correspondence with NMFS NEFSC, and other sources of information. A complete administrative record of this consultation will be kept on file at NMFS NERO.

1.0 CONSULTATION HISTORY

On November 24, 2008, the NEFSC Operations, Management, and Information (OMI) Division requested section 7 consultation for the proposed funding in the form of pounds of summer flounder, scup, black sea bass, bluefish, and *Loligo* squid to VIMS under the 2009 Mid-Atlantic RSA Program in support of the NEAMAP Near Shore Trawl Program. Based on conversations with OMI Division staff and information provided in the EA for the action, the request for consultation includes the Spring and Fall 2009 surveys given that funding awarded from the 2009 Mid-Atlantic RSA program would be used by VIMS for both surveys.

The study design for the 2009 NEAMAP surveys includes using bottom trawl gear for consecutive 30-day periods between April 13 and May 29 (spring) and between September 14 and November 20 (fall). The spring survey is proposed to start at the southernmost sampling stations around Cape Hatteras, NC and head north to Montauk, NY as Mid-Atlantic waters warm from April to May. The fall survey is proposed to start at the northernmost sampling stations around Montauk, NY and head south to Cape Hatteras, NC as Mid-Atlantic waters cool from September to November. The Regional Administrator of NERO has concurred with the NEFSC OMI Division that the use of bottom trawl gear for the surveys may adversely affect loggerhead sea turtles as a result of physical contact with and capture in the gear given that: (a) the use of the trawl gear will overlap in time and area with the distribution of loggerhead sea turtles in the survey area in the spring and fall, (b) loggerhead sea turtle interactions with comparable trawl gear in the survey area have occurred during NEFSC spring and fall bottom trawl surveys, and (c) sea turtle interactions with commercial trawl gear have occurred in this same area during the same seasons. Formal consultation was, therefore, initiated by NMFS NERO on December 23, 2008, the date on which all necessary information to conduct the consultation was received.

NMFS previously consulted on its funding of the Fall 2008 NEAMAP trawl survey under the 2008 Mid-Atlantic RSA Program. That consultation was initiated on August 8, 2008, and considered the effects to ESA-listed species under NMFS jurisdiction as a result of funding the trawl survey that was conducted in nearshore waters from Montauk, NY to Cape Hatteras, NC in the Fall 2008. The consultation was completed on September 19, 2008, and concluded that the proposed action may adversely affect but was not likely to jeopardize the continued existence of loggerhead sea turtles. An Incidental Take Statement (ITS) along with non-discretionary Reasonable and Prudent Measures (RPMs) to minimize the impacts of incidental take of loggerheads were also provided. The proposed action was not expected to adversely affect leatherback, Kemp's ridley, green, and hawksbill sea turtles; shortnose sturgeon; the Gulf of Maine Distinct Population Segment (DPS) of Atlantic salmon; or ESA-listed cetaceans.

NMFS also previously consulted on its funding of the NEAMAP pilot trawl survey of Fall 2006. That consultation, which was initiated on November 28, 2005 and completed on May 5, 2006, concluded that the proposed action may adversely affect but was not likely to jeopardize the continued existence of loggerhead, leatherback, Kemp's ridley, or green sea turtles. An ITS and non-discretionary RPMs to minimize the impacts of incidental take of these sea turtle species were provided. The proposed action was not expected to adversely affect shortnose sturgeon, the Gulf of Maine DPS of Atlantic salmon, hawksbill sea turtles, or ESA-listed cetaceans.

2.0 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is the Spring and Fall 2009 NEAMAP trawl surveys to be conducted by VIMS in nearshore waters along the U.S. east coast from Montauk, NY to Cape Hatteras, NC and inclusive of Block Island and Rhode Island Sounds. The purpose of these surveys is to collect data on the living marine resources in the designated area for the NEAMAP Near Shore Trawl Program (VIMS 2008). A summary of the proposed action relevant to the analysis of its potential effects on threatened and endangered species is presented below.

The NEAMAP surveys are intended to be a complement to the NEFSC bottom trawl surveys that are conducted from the Gulf of Maine to Cape Hatteras in the spring and fall of each year. The NEFSC surveys are conducted in waters less than approximately 1,800 feet (300 fathoms; 549 meters), but few stations have been sampled in waters less than 90 feet (15 fathoms; 27.4 meters) due to the size and draft of the survey vessel. With the larger, deeper-draft *FSV Henry B. Bigelow* coming online in 2009, survey coverage of near shore areas is expected to be even less, and waters less than 60 feet (10 fathoms; 18.3 meters) will no longer be surveyed by the NEFSC.

The objective of the NEAMAP Near Shore Trawl Program, in general, is to survey areas undersampled or not sampled by the NEFSC trawl surveys and to collect data on the diversity, biomass, relative abundance, and distribution of living marine resources that occur in waters of the Mid-Atlantic and Southern New England regions, from approximately Martha's Vineyard, MA to Cape Hatteras, NC. The protocol for the Spring and Fall 2009 NEAMAP surveys, which is discussed in detail in VIMS (2008), is as follows:

- a single vessel, to be determined through an annual contract, will be used for the surveys;
- the vessel will tow a bottom otter trawl net with varying mesh-sizes in different panels;
- tows will only be conducted during daylight hours;
- each tow will be 20 minutes in duration;
- the target tow speed will be 3.1 knots;
- trawling will occur in waters of Rhode Island Sound and Block Island Sound at depths of 60-120 feet (10-20 fathoms; 18.3-37 meters);
- trawling will occur in waters from Montauk, NY to Cape Hatteras, NC at depths of 20-60 feet (3.3-10 fathoms; 6-18 meters);
- the spring survey will be conducted for an approximately 30-day period starting in mid to late April, and will start sampling at the southernmost stations and work northward;
- the fall survey will be conducted for an approximately 30-day period starting in mid to late September, and will start sampling at the northernmost stations and work southward; and,
- a total of 150 randomly selected stations will be sampled during each cruise, with approximately 18 of these stations located in the Dr. Carl N. Shuster, Jr. Horseshoe Crab Reserve, which is a 1,500-square mile reserve in Federal waters adjacent to Delaware Bay.

2.1 Action Area

The action area for an Opinion is defined as all of the areas directly or indirectly affected by the Federal action, and not merely the immediate area involved in the action. NMFS anticipates that the only effects on ESA-listed species and their habitat as a result of the survey are the direct effects of interaction between sea turtles and bottom trawl gear that will be used for the survey, and the effects on other marine organisms (*i.e.*, sea turtle prey) on or very near the seafloor from towing the trawl net. Therefore, for the purpose of this consultation, the action area for the proposed action is defined by the area in which bottom trawl gear for the project will be operated, roughly all U.S. Atlantic coastal ocean waters from Montauk, NY to Cape Hatteras, NC from 20-60 feet in depth and also all waters in Rhode Island and Block Island Sounds from 60-120 feet in depth.

3.0 STATUS OF THE SPECIES

NMFS has determined that the actions being considered in the Opinion may adversely affect the following sea turtle species provided protection under the ESA:

Common name	Scientific name	ESA Status
Loggerhead sea turtle	*Caretta caretta*	Threatened

NMFS has determined that the actions being considered in the Opinion are not likely to adversely affect shortnose sturgeon (*Acipenser brevirostrum*), the Gulf of Maine DPS of Atlantic salmon (*Salmo salar*), leatherback sea turtles (*Dermochelys coriacea*), Kemp's ridley sea turtles (*Lepidochelys kempii*), green sea turtles (*Chelonia mydas*), hawksbill sea turtles (*Eretmochelys imbricata*), North Atlantic right whales (right whales) (*Eubalaena glacialis*), humpback whales (*Megaptera novaeangliae*), fin whales (*Balaenoptera physalus*), sei whales (*Balaenoptera borealis*), blue whales (*Balaenoptera musculus*), and sperm whales (*Physeter macrocephalus*), all of which are listed as endangered species under the ESA[1]. Thus, these species will not be considered further in this Opinion. The following discussion is NMFS's rationale for these determinations.

Shortnose sturgeon are benthic fish that occur in large coastal rivers of eastern North America. They range from as far south as the St. Johns River, Florida (possibly extirpated from this system) to as far north as the Saint John River in New Brunswick, Canada. The species is anadromous in the southern portion of its range (*i.e.*, south of Chesapeake Bay), while some northern populations are amphidromous (NMFS 1998a). Given the range of the species, shortnose sturgeon are not expected to be present in the area where trawl effort for the survey will occur.

The wild populations of Atlantic salmon found in rivers and streams from the lower Kennebec River north to the U.S. - Canada border are listed as endangered under the ESA (Fay *et al.* 2006). Juvenile salmon in New England rivers typically migrate to sea in May after a two- to three-year period of development in freshwater streams, and remain at sea for two winters before returning to their U.S. natal rivers to spawn. Results from a 2001 post-smolt trawl survey in Penobscot Bay and the nearshore waters of the Gulf of Maine indicate that Atlantic salmon post-smolts are prevalent in the upper water column throughout this area in mid to late May. Therefore, commercial fisheries deploying small mesh active gear (pelagic trawls and purse seines within 10 m of the surface) in nearshore waters of the Gulf of Maine may have the potential to incidentally take smolts. Since in-water work for the trawl survey will not occur in or near rivers where Atlantic salmon are likely to be found and the gear will operate in the ocean at or near the bottom rather than near the surface, Atlantic salmon belonging to the Gulf of Maine DPS are not expected to be present in the areas where trawl effort for the survey will occur.

[1] Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered. Due to the inability to distinguish between these populations away from the nesting beach, green sea turtles are considered endangered wherever they occur in U.S. waters.

The hawksbill sea turtle is uncommon in the waters of the continental U.S. Hawksbills prefer coral reef habitats, such as those found in the Caribbean and Central America. Mona Island (Puerto Rico) and Buck Island (St. Croix, U.S. Virgin Islands) contain especially important foraging and nesting habitat for hawksbills. Within the continental U.S., nesting is restricted to the southeast coast of Florida and the Florida Keys, but nesting is rare in these areas. Hawksbills have been recorded from all the Gulf States and along the east coast of the U.S. as far north as Massachusetts, but sightings north of Florida are rare. Aside from Florida, Texas is the only other U.S. state where hawksbills are sighted with any regularity. Since hawksbill sea turtles are not expected to be present in the areas where trawl effort for the survey will occur, it is highly unlikely that the proposed action will affect this sea turtle species.

Sperm whales and blue whales are also unlikely to occur in areas where bottom otter trawl gear for the survey will operate. During surveys for the Cetacean and Turtle Assessment Program (CeTAP), sperm whales were observed along the shelf edge, centered around the 1,000 m depth contour but extending seaward out to the 2,000 m depth contour (CeTAP 1982). Although blue whales are occasionally seen in U.S. waters, they are more commonly found in Canadian waters and are rare in continental shelf waters of the eastern U.S. (Waring *et al.* 2000). Given the predominantly offshore distribution of these two cetacean species, both are highly unlikely to be affected by the NEAMAP surveys.

North Atlantic right whales, humpback whales, fin whales, and sei whales do occur in the area where the surveys will be conducted. Nevertheless, none of these are expected to be affected by the use of bottom otter trawl gear for the survey given the following. Right whales, humpback whales, and fin whales occur in Mid-Atlantic and New England waters over the continental shelf. Sei whales are also observed over the continental shelf although they typically occur over the continental slope or in basins situated between banks (NMFS 1998b). All four species follow a similar, general pattern of foraging at high latitudes (*e.g.*, southern New England and Canadian waters) in the spring and summer months and calving in lower latitudes (*i.e.*, off of Florida for right whales and in the West Indies for humpback whales) in the winter months (CeTAP 1982; Hain *et al.* 1992; Clark 1995; Perry *et al.* 1999; Horwood 2002; Kenney 2002). Some non-breeding animals may remain in higher latitudes during the calving season or move offshore. Therefore, in-water work for the survey may overlap with the distribution of these cetacean species during part of the proposed project. However, large cetaceans have the speed and maneuverability to get out of the way of oncoming mobile gear, including trawl gear. Observer coverage of many fishing trips using mobile gear (*e.g.*, dredge, trawl gear) have shown that these gear types do not pose a reasonable risk of entanglement or capture for large cetaceans.

NMFS has also determined that in-water work for the survey will not have any adverse effects on cetacean prey. Right and sei whales feed on copepods (Horwood 2002; Kenney 2002). The use of trawl gear for the proposed project will not affect the availability of copepods for foraging right and sei whales because copepods are very small organisms that will pass through the gear rather than being captured in it. Blue whales feed on euphausiids (krill) (Sears 2002) which, likewise, are too small to be captured in the gear. Humpback and fin whales also feed on krill as well as small schooling fish (*e.g.*, sand lance, herring, and mackerel) found within the water column (Aguilar 2002; Clapham 2002). The trawl gear used for the survey will operate on or

very near the bottom. Therefore, the fish species caught in such gear would be species that live in benthic habitats (on or very near the bottom) such as flounders and other groundfish versus schooling fish such as herring and mackerel that occur within the water column. Therefore, the in-water work for the Spring and Fall 2009 NEAMAP surveys will not affect the availability of prey for foraging humpback or fin whales. Sperm whales feed on larger organisms that inhabit the deeper ocean regions (Whitehead 2002). Bottom otter trawl gear for the Spring and Fall 2009 NEAMAP surveys will not operate in these deep water areas. Therefore, the Spring and Fall 2009 NEAMAP surveys will not affect the availability of prey for foraging sperm whales.

The in-water work for the Spring and Fall 2009 NEAMAP surveys will not occur in low latitude waters where calving and nursing occurs for these large cetacean species (Aguilar 2002; Clapham 2002; Horwood 2002; Kenney 2002; Sears 2002; Whitehead 2002). Therefore, the use of trawl gear in relation to the proposed action will not affect the oceanographic conditions that are conducive for these behaviors.

Leatherback, Kemp's ridley, and green sea turtles also occur seasonally in waters where the surveys will be conducted. In general, sea turtles move up the U.S. Atlantic coast from southern wintering areas south of Cape Hatteras, NC as water temperatures warm in the spring (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; James *et al.* 2005a, 2005b; Eckert *et al.* 2006; Murphy *et al.* 2006). The trend is reversed in the fall as water temperatures cool. Nevertheless, none of these species are expected to be affected by the use of bottom otter trawl gear for the Spring and Fall 2009 NEAMAP surveys. During comparable spring and fall bottom otter trawl surveys conducted by the NEFSC from 1963-2006, a total of 62 sea turtles were observed captured during 35,571 tows, all of which were loggerhead sea turtles (NMFS 2007a). Bottom otter trawl surveys conducted by the NEFSC in the spring and fall of 2007 and 2008 captured an additional 3 sea turtles in the action area, all of which were again loggerheads (Linda Despres, NEFSC, pers. comm. to Lynn Lankshear, NERO, 2008). The NEFSC has also recorded captures of sea turtles in bottom otter trawl gear used to target fish (not including scallops or shrimp) in commercial fisheries in New England and Mid-Atlantic waters (a broader area than the action area of this consultation). Of the 119 sea turtles reported captured from January 1994 to December 2008, 108 were loggerhead sea turtles (Murray 2006; NEFSC Fisheries Sampling Branch [FSB] on-line database). Of the remaining 11, 3 were Kemp's ridleys, 2 were leatherbacks, and 6 were not unidentified (Murray 2006, NEFSC FSB on-line database). These results are not surprising given that loggerhead sea turtles are believed to be the most abundant of the four sea turtle species that seasonally occur in Mid-Atlantic waters north of Cape Hatteras and off southern New England (CeTAP 1982; Shoop and Kenney 1992; Lutcavage and Musick 1985; Keinath *et al.* 1987; Morreale and Standora 1993; Spotila *et al.* 1998).

Trawl gear used for the Spring and Fall 2009 NEAMAP surveys will be in the water for a relatively short period of time. Given that the trawl gear will only be towed for 20 minutes per tow, the maximum overall length of bottom contact time for the 150 stations to be sampled during each survey is expected to be 50 hours (1 survey tow per station x 150 stations x 0.33 hours per tow).

While the precise relationship between effort (in terms of the amount of time that gear is in the water) and the likelihood of a sea turtle interaction is unknown, it is reasonable to conclude that the less time that gear is in the water, the less chance there is that an interaction will occur. As shown by the data collected during the NEFSC bottom trawl surveys and by observers on commercial bottom otter trawl trips, the observed rate of interaction for Kemp's ridley and leatherback sea turtles in bottom otter trawl gear in the action area is very low, and is zero for green sea turtles. NMFS, therefore, considers interactions between these species and bottom otter trawl gear to be such rare events that it is extremely unlikely that any of these species will be captured or otherwise come into physical contact with bottom otter trawl gear used in the surveys during the relatively limited period of time that the gear will be towed in Mid-Atlantic and southern New England waters.

The use of bottom trawl gear for the Spring and Fall 2009 NEAMAP surveys will not reduce the availability of prey for leatherback, Kemp's ridley, or green sea turtles. The trawl gear is expected to catch a variety of organisms including fish and crab species (NEFSC 2006a, 2006b, 2007; VIMS 2008). None of these are typical prey species of leatherback sea turtles or of neritic juvenile or adult green sea turtles (Rebel 1974; Mortimer 1982; Bjorndal 1985, 1997; USFWS and NMFS 1992). Those organisms that are caught in the trawl will be sampled according to the survey protocol (VIMS 2008). Species that meet the sampling criteria will be sampled for scientific purposes and not returned to the water, while the other species will be returned to the water alive, dead, or injured to the extent that they will subsequently die. All of the species that will be retained for further study are fish. Crabs, on the other hand, which are the preferred prey of Kemp's ridley sea turtles, will not be retained for further study, and thus would still be available as prey when returned to the water. This is due to the knowledge that Kemp's ridley sea turtles eat a variety of live prey as well as scavenge dead organisms (Lutcavage and Musick 1985; Keinath *et al.* 1987; Dodd 1988; Burke *et al.* 1993, 1994; Morreale and Standora 2005). Thus, the Spring and Fall 2009 NEAMAP surveys are not expected to affect the availability of prey for Kemp's ridley sea turtles in the action area given that: (a) the sea turtle food items that are returned to the water could still be preyed upon by Kemp's ridleys, (b) the number of trawl tows for the study are limited in scope and duration, (c) the priority species that will be retained for scientific analysis are all fish species, which are not the preferred prey for Kemp's ridley sea turtles (Keinath *et al.* 1987; Lutcavage and Musick 1985; Burke *et al.* 1993, 1994; Morreale and Standora 2005), and (d) nesting by Kemp's ridley sea turtles has increased for the last several years, strongly suggesting that the species is not food limited.

The operation of a vessel on the water and the use of bottom otter trawl gear by that vessel for the Spring and Fall 2009 NEAMAP surveys will have insignificant effects on leatherback, Kemp's ridley, and green sea turtles. The single vessel that will operate on the water as a result of the proposed action is unlikely to strike a leatherback, Kemp's ridley, or green sea turtle in the action area given that: (a) the vessel will operate/travel at a slow speed such that a sea turtle would have the speed and maneuverability to avoid contact with the vessel, (b) these sea turtle species spend part of their time at depths out of the range of a vessel collision, and (c) the proposed action is not expected to increase the amount of vessel traffic in areas where sea turtles occur given the limited number of vessels used in the study.

The use of bottom otter trawl gear for the Spring and Fall 2009 NEAMAP surveys is expected to have an insignificant effect on bottom habitat utilized by leatherback, Kemp's ridley, and green sea turtles. A panel of experts have previously concluded that the effects of even light weight otter trawl gear would include: (1) the scraping or plowing of the doors on the bottom, sometimes creating furrows along their path, (2) sediment suspension resulting from the turbulence caused by the doors and the ground gear on the bottom, (3) the removal or damage to benthic or demersal species, and (4) the removal or damage to structure forming biota. The panel also concluded that the greatest impacts from bottom otter trawls occur in high and low energy gravel habitats and in hard clay outcroppings, and that sand habitats were the least likely to be impacted (NREFHSC 2002). The areas to be surveyed for the Spring and Fall 2009 NEAMAP surveys include very few habitats that are purely gravel or hard clay—so few that the area encompassed by these habitats is insignificant compared to the area encompassed by sand and silt type habitats, which are more resilient to bottom trawling. For sea turtles, the effects on habitat due to bottom otter trawl gear would be felt as an effect on their benthic prey species. As stated above, the effects on sea turtle prey items are expected to be insignificant.

3.1 Status of Loggerhead Sea Turtles

Loggerhead sea turtles are a cosmopolitan species. They are found in temperate and subtropical waters and occupy a range of habitats including offshore waters, continental shelves, bays, estuaries, and lagoons. The loggerhead is the most abundant species of sea turtle in U.S. waters. Genetic differences exist between loggerhead sea turtles that nest and forage in the different ocean basins (Bowen 2003; Bowen and Karl 2007). Differences in the maternally inherited mitochondrial DNA also exist between loggerhead nesting groups that occur within the same ocean basin (TEWG 2000; Pearce 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). Site fidelity of females to one or more nesting beaches in an area is believed to account for these genetic differences (TEWG 2000; Bowen 2003). However, loggerhead sea turtles are currently listed under the ESA at the species level rather than as subspecies or distinct population segments (DPS). The ESA requires NMFS to ultimately conclude whether the actions under consultation, in light of the Environmental Baseline (Section 4.0) and Cumulative Effects (Section 5.0), are likely to jeopardize the species as it is listed. Therefore, information on the range-wide status of the species is included.

Pacific Ocean. In the Pacific Ocean, major loggerhead nesting grounds are generally located in temperate and subtropical regions with scattered nesting in the tropics. The abundance of loggerhead sea turtles at nesting colonies throughout the Pacific basin has declined dramatically over the past ten to twenty years. Loggerhead sea turtles in the Pacific Ocean are represented by a northwestern Pacific nesting group (located in Japan) and a smaller southwestern Pacific nesting group that occurs in Australia (Great Barrier Reef and Queensland), New Caledonia, New Zealand, Indonesia, and Papua New Guinea. Data from 1995 estimated the Japanese nesting group at 1,000 adult females (Bolten *et al.* 1996). More recent information suggests that nest numbers have increased somewhat over the period of 1998-2004 (NMFS and USFWS 2007). However, this time period is too short to make a determination of the overall trend in nesting (NMFS and USFWS 2007). Genetic analyses of loggerhead females nesting in Japan indicate the presence of genetically distinct nesting colonies (Hatase *et al.* 2002).

In Australia, long-term census data have been collected at some rookeries since the late 1960s and early 1970s, and nearly all the data show marked declines in nesting since the mid-1980s. The nesting group in Queensland, Australia was as low as 300 adult females in 1997 (Limpus and Limpus 2003).

Pacific loggerhead sea turtles are captured, injured, or killed in numerous Pacific fisheries including gillnet, longline, and trawl fisheries in the western and/or eastern Pacific Ocean (NMFS and USFWS 2007). In Australia, where sea turtles are taken in bottom trawl and longline fisheries, efforts have been made to reduce fishery bycatch (NMFS and USFWS 2007).

Indian Ocean. Loggerhead sea turtles are distributed throughout the Indian Ocean, along most mainland coasts and island groups (Baldwin *et al.* 2003). Throughout the Indian Ocean, loggerhead sea turtles face many of the same threats as in other parts of the world including loss of nesting beach habitat, fishery interactions, and turtle meat and/or egg harvesting.

In the southwestern Indian Ocean, loggerhead nesting has shown signs of recovery in South Africa where protection measures have been in place for decades. However, in other southwestern areas (*e.g.*, Madagascar and Mozambique) loggerhead nesting groups are still affected by subsistence hunting of adults and eggs (Baldwin *et al.* 2003). The largest known nesting group of loggerheads in the world occurs in Oman in the northern Indian Ocean. An estimated 20,000 to 40,000 females nest at Masirah, the largest nesting site within Oman, each year (Baldwin *et al.* 2003). In the eastern Indian Ocean, all known nesting sites are found in Western Australia (Dodd 1988). As has been found in other areas, nesting numbers are disproportionate within the area with the majority of nesting occurring at a single location. This may, however, be the result of fox predation on eggs at other Western Australia nesting sites (Baldwin *et al.* 2003).

Mediterranean Sea. Nesting in the Mediterranean Sea is confined almost exclusively to the eastern basin (Margaritoulis *et al.* 2003). The greatest numbers of nests in the Mediterranean are found in Greece with an average of 3,050 nests per year (Margaritoulis *et al.* 2003; NMFS and USFWS 2007). Turkey has the second largest number of nests with 2,000 nests per year (NMFS and USFWS 2007). There is a long history of exploitation for loggerheads in the Mediterranean (Margaritoulis *et al.* 2003). Although much of this is now prohibited, some directed captures still occur (Margaritoulis *et al.* 2003). Loggerheads in the Mediterranean also face the threat of habitat degradation, incidental fishery interactions, vessel strikes, and marine pollution (Margaritoulis *et al.* 2003). Longline fisheries, in particular, are believed to catch thousands of juvenile loggerheads each year (NMFS and USFWS 2007), although genetic analyses indicate that only a portion of the loggerheads captured originate from loggerhead nesting groups in the Mediterranean (Laurent *et al.* 1998).

Atlantic Ocean. Ehrhart *et al.* (2003) provided a summary of the literature identifying known nesting habitats and foraging areas for loggerheads within the Atlantic Ocean. Detailed information is also provided in the 5-year status review for loggerheads (NMFS and USFWS 2007) and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008), which was recently published by NMFS and FWS in December

2008 and is a second revision to the original recovery plan that was approved in 1984 (NMFS 1984) and most recently revised in 1991 (NMFS and USFWS 1991).

Briefly, nesting occurs on island and mainland beaches on both sides of the Atlantic and both north and south of the Equator (Ehrhart *et al.* 2003). By far, the majority of Atlantic nesting occurs on beaches of the southeastern U.S. (NMFS and USFWS 2007). Annual nest counts for loggerhead sea turtles on beaches from other countries are in the hundreds with the exception of Brazil, where a total of 4,837 nests were reported for the 2003-2004 nesting season (Marcovaldi and Chaloupka 2007; NMFS and USFWS 2007), and Mexico, where several thousand nests are estimated to be laid each year and the Yucatán nesting population had a range of 903-2,331 nests per year from 1987-2001 (Zurita *et al.* 2003; NMFS and USFWS 2008). In both the eastern and western Atlantic, waters as far north as 41°N to 42°N latitude are used for foraging by juveniles as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003). Of all loggerhead populations in the Atlantic Ocean, those comprising individuals that nest and/or forage in U.S. waters of the Northwest Atlantic have been most extensively studied.

In U.S. Atlantic waters, loggerheads commonly occur throughout the inner continental shelf from Florida to Cape Cod, Massachusetts and in the Gulf of Mexico from Florida to Texas, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Epperly and Braun-McNeill 2002; Mitchell *et al.* 2003). Loggerheads have been observed in waters with surface temperatures of 7E to 30EC, but water temperatures ≥11EC are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). The presence of loggerhead sea turtles in U.S. Atlantic waters is also influenced by depth. Aerial surveys of continental shelf waters north of Cape Hatteras, North Carolina indicate that loggerhead sea turtles are most commonly sighted in waters with bottom depths ranging from 22 to 49 m deep (Shoop and Kenney 1992). However, survey and satellite tracking data support that they occur in waters from the beach to beyond the continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007).

Loggerhead sea turtles occur year round in ocean waters off North Carolina, South Carolina, Georgia, and Florida. In these areas of the South Atlantic Bight, water temperature is influenced by the proximity of the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to migrate to inshore waters of the southeast U.S. (*e.g.*, Pamlico and Core Sounds) and also move up the U.S. Atlantic coast (Epperly *et al.* 1995a, 1995b, 1995c; Braun-McNeill and Epperly 2004), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June (Shoop and Kenney 1992). The trend is reversed in the fall as water temperatures cool. The large majority leave the Gulf of Maine by mid-September but some may remain in Mid-Atlantic and Northeast areas until late fall. By December, loggerheads have migrated from inshore and more northern coastal waters to waters offshore of North Carolina, particularly off of Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (Shoop and Kenney 1992; Epperly *et al.* 1995b; Epperly and Braun-McNeill 2002).

Loggerheads mate from late March to early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern U.S. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests per individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2 to 3 years, but can vary from 1 to 7 years (Dodd 1988).

For the past decade or so, the scientific literature has recognized five distinct nesting groups, or subpopulations, of loggerhead sea turtles in the Northwest Atlantic, divided geographically as follows: (1) a northern group of nesting females that nest from North Carolina to northeast Florida at about 29EN latitude; (2) a south Florida group of nesting females that nest from 29EN latitude on the east coast to Sarasota on the west coast; (3) a Florida Panhandle group of nesting females that nest around Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán group of nesting females that nest on beaches of the eastern Yucatán Peninsula, Mexico (Márquez 1990; TEWG 2000); and (5) a Dry Tortugas group that nests on beaches of the islands of the Dry Tortugas, near Key West, Florida (NMFS SEFSC 2001). Genetic analyses of mitochondrial DNA, which a sea turtle inherits from its mother, indicate that there are genetic differences between loggerheads that nest at and originate from the beaches used by each of the five identified nesting groups of females (TEWG 2000). However, analyses of microsatellite loci from nuclear DNA, which represents the genetic contribution from both parents, indicates little to no genetic differences between loggerheads originating from nesting beaches of the five Northwest Atlantic nesting groups (Pearce and Bowen 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). These results suggest that female loggerheads have site fidelity to nesting beaches within a particular area, while males provide an avenue of gene flow between nesting groups by mating with females that originate from different nesting groups (Bowen 2003; Bowen *et al.* 2005). The extent of such gene flow, however, is unclear (Shamblin 2007).

The lack of genetic structure makes it difficult to designate specific boundaries for the nesting subpopulations based on genetic differences alone. Therefore, the Loggerhead Recovery Team recently used a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to reassess the designation of these subpopulations to identify recovery units for use in the 2008 recovery plan.

In the final revised recovery plan, the Loggerhead Recovery Team designated five recovery units for the Northwest Atlantic population of loggerhead sea turtles based on the aforementioned nesting groups and inclusive of a few other nesting areas not mentioned above. The first four of these recovery units represent nesting assemblages located in the southeast U.S. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the U.S., but which occur within U.S. waters during some portion of their lives. The five recovery units representing nesting assemblages are: (1) the Northern Recovery Unit (NRU: Florida/Georgia border through southern Virginia), (2) the Peninsular Florida Recovery Unit (PFRU: Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (DTRU: islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (NGMRU: Franklin County, Florida through Texas), and (5) the Greater Caribbean Recovery Unit (GCRU: Mexico through French Guiana, The Bahamas, Lesser Antilles, and Greater Antilles). The Recovery Team evaluated the status and trends of the

Northwest Atlantic loggerhead population for each of the five recovery units, using nesting data available as of October 2008 (NMFS and USFWS 2008).

From the beginning of standardized surveys in 1989 until 1998, the PFRU, the largest nesting assemblage in the Northwest Atlantic by an order of magnitude, had a significant increase in the number of nests. However, from 1998 through 2007, Witherington *et al.* (2009) reported a decrease of 39.9% in annual nest counts. In 2008, a slight increase in nest counts was reported, but this did not alter the declining trend. The Loggerhead Recovery Team acknowledged that this dramatic change in status for the PFRU is a serious concern and requires immediate attention to determine the cause(s) of this change and the actions needed to reverse it. The NRU, the second largest nesting assemblage of loggerheads in the U.S., has been declining at a rate of 1.3% annually since standardized surveys were implemented in 1983. Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. The NGMRU has shown a significant declining trend of 6.8% annually since index nesting beach surveys were initiated in 1997. However, evaluation of long-term nesting trends for the NGMRU is difficult because of changed and expanded beach coverage. No statistical trends in nesting abundance can be determined for the DTRU because of the lack of long-term data. Similarly, statistically valid analyses of long-term nesting trends for the entire GCRU are not available because there are few long-term standardized nesting surveys representative of the region. Additionally, changing survey effort at monitored beaches and scattered and low-level nesting by loggerheads at many locations currently precludes comprehensive analyses (NMFS and USFWS 2008).

Sea turtle nesting surveys are important in that they provide information on the relative abundance of nesting each year, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The final revised recovery plan compiled the most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit.

Unlike nesting surveys, in-water studies of sea turtles typically sample both sexes and multiple age classes. In-water studies have been conducted in some areas of the Northwest Atlantic and provide data by which to assess the relative abundance of loggerhead sea turtles and changes in abundance over time (Maier *et al.* 2004; Morreale *et al.* 2005; Mansfield 2006; Ehrhart *et al.* 2007; Epperly *et al.* 2007). Maier *et al.* (2004) used fishery-independent trawl data to establish a regional index of loggerhead abundance for the southeast coast of the U.S. (Winyah Bay, South Carolina to St. Augustine, Florida) during the period 2000-2003. A comparison of loggerhead

catch data from this study with historical values suggested that in-water populations of loggerhead sea turtles along the southeast U.S. coast appear to be larger, possibly an order of magnitude higher than they were 25 years ago (Maier *et al.* 2004). A comparison of catch rates for sea turtles in pound net gear fished in the Pamlico-Albemarle Estuarine Complex of North Carolina between the years 1995-1997 and 2001-2003 similarly found a significant increase in catch rates for loggerhead sea turtles for the latter period (Epperly *et al.* 2007). A long-term, on-going study of loggerhead abundance in the Indian River Lagoon System of Florida found a significant increase in the relative abundance of loggerheads over the last 4 years of the study (Ehrhart *et al.* 2007). However, there was no discernible trend in loggerhead abundance during the 24-year time period of the study (1982-2006) (Ehrhart *et al.* 2007).

In contrast to these studies, Morreale *et al.* (2005) observed a decline in the percentage and relative numbers of loggerhead sea turtles incidentally captured in pound net gear fished around Long Island, New York during the period 2002-2004 in comparison to the period 1987-1992, with only two loggerheads observed captured in pound net gear during the period 2002-2004. No additional loggerheads were reported captured in pound net gear through 2007, although 2 were found cold-stunned on Long Island bay beaches in the fall of 2007 (Memo to the File, L. Lankshear, December 2007). Potential explanations for this decline include major shifts in loggerhead foraging areas and/or increased mortality in pelagic or early benthic stage/age classes (Morreale *et al.* 2005). Using aerial surveys, Mansfield (2006) also found a decline in the densities of loggerhead sea turtles in Chesapeake Bay over the period 2001-2004 compared to aerial survey data collected in the 1980s. Significantly fewer loggerheads ($p<0.05$) were observed in both the spring (May-June) and the summer (July-August) of 2001-2004 compared to those observed during aerial surveys in the 1980s (Mansfield 2006). A comparison of median densities from the 1980s to the 2000s suggested that there had been a 63.2% reduction in densities during the spring residency period and a 74.9% reduction in densities during the summer residency period (Mansfield 2006). The decline in observed loggerhead populations in Chesapeake Bay may be related to a significant decline in prey, namely horseshoe crabs and blue crabs, with loggerheads redistributing outside of Bay waters where crabs may be more abundant.

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. Recent studies have established that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007). One of the studies tracked the movements of adult post-nesting females and found that differences in habitat use were related to body size with larger turtles staying in coastal waters and smaller turtles traveling to oceanic waters (Hawkes *et al.* 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters and others moving off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes *et al.* (2006) study, there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007). In either case, the research not only supports the need to revise the life history model for

loggerheads but also demonstrates that threats to loggerheads in both the neritic and oceanic environments are likely impacting multiple life stages of this species.

The 5-year status review and final revised recovery plan provide a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007, 2008). Amongst those of natural origin, hurricanes are known to be destructive to sea turtle nests. Sand accretion, rainfall, and wave action that result from these storms can appreciably reduce hatchling success. Other sources of natural mortality include cold stunning and biotoxin exposure.

Anthropogenic factors that impact hatchlings and adult females on land, or the success of nesting and hatching include: beach erosion, beach armoring, and nourishment; artificial lighting; beach cleaning; increased human presence; recreational beach equipment; beach driving; coastal construction and fishing piers; exotic dune and beach vegetation; and poaching. An increased human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (*e.g.*, raccoons, armadillos, and opossums) which raid nests and feed on turtle eggs (NMFS and USFWS 2007, 2008). Although sea turtle nesting beaches are protected along large expanses of the Northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected high density east Florida nesting beaches from Indian River to Broward County are affected by all of the above threats.

Loggerheads are affected by a completely different set of anthropogenic threats in the marine environment. These include oil and gas exploration, coastal development, and transportation; marine pollution; underwater explosions; hopper dredging; offshore artificial lighting; power plant entrainment and/or impingement; entanglement in debris; ingestion of marine debris; marina and dock construction and operation; boat collisions; poaching; and fishery interactions.

A 1990 National Research Council (NRC) report concluded that for juveniles, subadults, and breeders in coastal waters, the most important source of human caused mortality in U.S. Atlantic waters was fishery interactions. Of these, the U.S. south Atlantic and Gulf of Mexico shrimp fisheries were considered to pose the greatest cause of mortality to neritic juvenile and adult age classes of loggerheads, accounting for an estimated 5,000 to 50,000 loggerhead deaths each year (NRC 1990). Significant changes to the south Atlantic and Gulf of Mexico shrimp fisheries have occurred since 1990, and the effects of these shrimp fisheries on ESA-listed species, including loggerhead sea turtles, have been assessed several times through section 7 consultation. There is also a lengthy regulatory history with regard to the use of Turtle Excluder Devices (TEDs) in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries (Epperly and Teas 2002; NMFS 2002; Lewison *et al.* 2003). Section 7 consultation was reinitiated in 2002 to, in part, consider the effect of a new rulemaking that would require increasing the size of TED escape openings to allow larger loggerheads (and green sea turtles) to escape from shrimp trawl gear. The resulting Opinion was completed in December 2002 and concluded that, as a result of the new rule, annual loggerhead mortality from capture in shrimp trawls would decline from an estimated 62,294 to 3,947 turtles assuming that all TEDs were installed properly and that compliance was 100% (Epperly *et al.* 2002; NMFS 2002). The total level of take for loggerhead sea turtles (individuals

caught in the gear regardless of whether they subsequently escaped through the TED opening) as a result of the U.S. south Atlantic and Gulf of Mexico shrimp fisheries was estimated to be 163,160 loggerheads per year (NMFS 2002). On February 21, 2003, NMFS issued the final rule in the *Federal Register* to require the use of the larger opening TEDs (68 FR 8456). The rule also provided the measures to disallow several previously approved TED designs that did not function properly under normal fishing conditions, and to require modifications to the trynet and bait shrimp exemptions to the TED requirements to decrease mortality of sea turtles.

The NRC (1990) report also stated that other U.S. Atlantic fisheries collectively accounted for 500 to 5,000 loggerhead deaths each year, but recognized that there was considerable uncertainty in the estimate. Subsequent studies suggest that these numbers were underestimated. For example, the first estimate of loggerhead sea turtle bycatch in U.S. Mid-Atlantic bottom otter trawl gear was completed in September 2006 (Murray 2006). Observers reported 66 loggerhead sea turtle interactions with bottom otter trawl gear during the period of which 38 were reported as alive and uninjured and 28 were reported as dead, injured, resuscitated, or of unknown condition (Murray 2006). Seventy-seven percent of observed sea turtle interactions occurred on vessels fishing for summer flounder (50%) and croaker (27%). The remaining 23% of observed interactions occurred on vessels targeting weakfish (11%), long-finned squid (8%), groundfish (3%), and short-finned squid (1%). Based on observed interactions and fishing effort as reported on Vessel Trip Reports (VTRs), the average annual loggerhead bycatch in these bottom otter trawl fisheries combined was estimated to be 616 sea turtles per year for the period 1996-2004 (Murray 2006).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) Fishery Management Plan (FMP) were estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each 3-year period (NMFS 2004). NMFS has mandated gear changes for the HMS fishery to reduce sea turtle bycatch and the likelihood of death from those takes that would still occur (Fairfield-Walsh and Garrison 2007). In 2006, there were 46 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery. Nearly all of the loggerheads (42 of 46) were released alive but with injuries (Fairfield-Walsh and Garrison 2007). The majority of the injured sea turtles had been hooked internally (Fairfield-Walsh and Garrison 2007). Based on the observed take, an estimated 561 (range = 318-981) loggerhead sea turtles are estimated to have been taken in the longline fisheries managed under the HMS FMP in 2006 (Fairfield-Walsh and Garrison 2007). This number is an increase from 2005 when 274 loggerheads were estimated to have been taken in the fisheries, but is still lower than some previous years in the period of 1992-2006 (Fairfield-Walsh and Garrison 2007). This fishery represents just one of several longline fisheries operating in the Atlantic Ocean. Lewison *et al.* (2004) estimated that 150,000-200,000 loggerheads were taken in the Atlantic longline fisheries in 2000 (includes the U.S. Atlantic tuna and swordfish longline fisheries as well as others).

Summary of Status for Loggerhead Sea Turtles

Loggerheads are a long-lived species and reach sexual maturity relatively late at around 20-38 years (NMFS SEFSC 2001). The species continues to be affected by many factors occurring on nesting beaches and in the water. These include poaching, habitat loss, and nesting predation by

introduced species that affect hatchlings and nesting females on land, as well as fishery interactions, vessel interactions, and non-fishery (e.g., dredging) operations affecting all sexes and age classes in the water (NRC 1990; NMFS and USFWS 2007). As a result, loggerheads still face many of the original threats that were the cause of their listing under the ESA.

There are no population estimates for loggerhead sea turtles in any of the ocean basins in which they occur. Based on their 5-year status review of the species, NMFS and USFWS (2007) determined that loggerhead sea turtles should not be delisted or reclassified as endangered.

Based on the most recent information, a decline in the annual nest counts has been measured or suggested for three of the five recovery units for loggerheads in the Northwest Atlantic. These include the PFRU, which is the largest (in terms of number of nests laid) in the Atlantic Ocean. NMFS has convened a new Loggerhead Turtle Expert Working Group (TEWG) to review all available information on Atlantic loggerheads in order to determine what can be said about the status of this species in the Atlantic. A final report from the Loggerhead TEWG is not yet available. An interim update was provided by the Loggerhead TEWG to NMFS in December 2007 (letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007).

In summary, the memo stated that nest counts, fishery dependent data, and stranding data do not provide the necessary insight into loggerhead sea turtle population dynamics to properly assess species status. As has been stated in the literature (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005), the TEWG remarked that nest counts alone provide no insight into the trend/abundance of sexually mature males or of other age classes of either sex (letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007). In addition, the TEWG stated that interpreting the meaning of a decline in nest counts in terms of the status/trend of the number of nesting females in the population is difficult since converting nest counts to the number of nesting females is confounded by several issues such as variability in the number of nests per female per year; variability in remigration interval; and, as the ability to nest is resource dependent, the effect of habitat changes and the availability of food resources. The TEWG is continuing to explore several hypotheses for why nest counts have been declining. These hypotheses will be more fully discussed in the final report (letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007).

Finally, as mentioned previously, a final revised recovery plan for loggerhead sea turtles in the Northwest Atlantic was recently published by NMFS and FWS in December 2008. The revised recovery plan is significant in that it identifies five unique recovery units, which comprise the population of loggerheads in the Northwest Atlantic, and describes specific recovery criteria for each recovery unit.

4.0 ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, Federal, or private actions and other human activities in the action area, the anticipated impacts

of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that may affect the survival and recovery of loggerhead sea turtles in the action area. The activities generally fall into one of the following three categories: (1) fisheries, (2) other activities that cause death or otherwise impair a sea turtle's ability to function, and (3) recovery activities associated with reducing impacts to ESA-listed sea turtles.

Many of the fisheries and other activities causing death or injury to loggerhead sea turtles that are identified in this section have occurred for years, even decades. Similarly, while some recovery activities have been in place for years (*e.g.*, nesting beach protection in portions of loggerhead nesting habitat), others have been undertaken more recently following new information on the impact of certain activities on the species.

The past impacts of each state, Federal, and private action or other human activity in the action area cannot be particularized in their entirety. However, to the extent they have manifested themselves at the population level, such past impacts are subsumed in the information presented on the status and trend of loggerhead sea turtles, recognizing that the benefits to loggerhead sea turtles as a result of recovery activities already implemented may not be evident in the status and trends of the population for years given the relatively late age to maturity for loggerhead sea turtles, and depending on the age class(es) affected.

4.1 Fishery Operations

4.1.1 Federal fisheries

Commercial and recreational fisheries in the action area employ gear that is known to harass, injure, and/or kill loggerhead sea turtles. Several federally regulated fisheries that use gillnet, longline, trawl, and pot/trap gear have been documented as unintentionally capturing, entangling, or hooking loggerheads. In some cases, loggerheads are harmed, injured, or killed as a result of the interaction. Available information suggests that loggerheads can be captured, entangled, or hooked in these gear types when the operation of the gear overlaps with the distribution of the species.

Loggerhead sea turtles are also known to be killed and injured as a result of being struck by vessels on the water. However, for the following reasons, the operation of fishing vessels used in the aforementioned fisheries will have discountable effects on loggerhead sea turtles. First, fishing vessels operate at relatively slow speeds, particularly when towing or hauling gear. Thus, sea turtles in the path of a fishing vessel would likely be able to move out of the vessel's path before being struck. Second, fishing effort for all of the Federal fisheries within the action area is constrained in some way, either through a limited access permit system or by fishing quotas, thus limiting the amount of time that vessels are on the water. The less the time that vessels are on the water, the less opportunity for vessel collisions with loggerhead sea turtles. Also, loggerhead sea turtles occur seasonally in coastal ocean waters off of North Carolina through

Massachusetts so that a portion of the fishing in these waters occurs at times when sea turtles are not likely to be present. Finally, loggerhead sea turtles do not occur strictly at or within close proximity to the water surface (Morreale 1999), meaning that they spend part of their time at depths out of range of a collision with boats. For these reasons, the impacts of federally permitted fishing vessels themselves on loggerhead sea turtles are negligible.

The types of gear used in the Federal fisheries described below are also expected to have an insignificant effect on loggerhead prey and the bottom habitat utilized by loggerhead sea turtles. Loggerhead prey items such as crabs and mollusks are removed from the marine environment as fisheries bycatch in one or more of the fisheries discussed below. While some of the bycatch is likely returned to the water dead or injured to the extent that the organisms will shortly die, they would still be available as prey for loggerhead sea turtles, which are known to eat a variety of live prey as well as scavenge dead organisms (Lutcavage and Musick 1985; Keinath *et al.* 1987; Dodd 1988; Burke *et al.* 1993; Morreale and Standora 2005).

Several of the fisheries below use bottom otter trawl gear. A panel of experts have previously concluded that the effects of even light weight otter trawl gear would include: (1) the scraping or plowing of the doors on the bottom, sometimes creating furrows along their path, (2) sediment suspension resulting from the turbulence caused by the doors and the ground gear on the bottom, (3) the removal or damage to benthic or demersal species, and (4) the removal or damage to structure forming biota. The panel also concluded that the greatest impacts from otter trawls occur in high and low energy gravel habitats and in hard clay outcroppings, and that sand habitats were the least likely to be impacted (NREFHSC 2002). The action area in which these Federal fisheries occur along the U.S. Atlantic coast includes very few habitats that are purely gravel or hard clay—so few that the area encompassed by these habitats is insignificant compared to the area encompassed by sand and silt type habitats, which are more resilient to bottom trawling. Fixed gear (e.g., pots, traps, and sink gillnets) is expected to have less of an effect on bottom habitat than mobile gear. For loggerhead sea turtles, the effects on habitat due to bottom otter trawl gear would be felt as an effect on their benthic prey species. As stated above, the effects on loggerhead sea turtle prey items are expected to be insignificant.

Formal ESA section 7 consultations have been conducted on the fisheries authorized under the Atlantic bluefish, Atlantic mackerel/squid/butterfish, monkfish, northeast multispecies, skate, spiny dogfish, and summer flounder/scup/black sea bass FMPs as well as for the American lobster fishery. An ITS has been issued for the incidental take of loggerhead sea turtles in each of these fisheries. The ITS reflects the incidental take of loggerheads and other ESA-listed species anticipated from the date of the ITS and forward in time.

Each of these fisheries employs gear that has been known to capture, injure, and kill loggerhead sea turtles. However, given the relatively narrow action area (in terms of water depths surveyed) and the broad area of operation for the fisheries, only a portion of the fishing effort for each of these fisheries is expected to occur within the action area of this consultation. A summary of the impacts of each of these fisheries that has been subject to section 7 consultation is provided below, but more detailed information can be found in the respective biological opinions. The information describes times and areas where the fishery presently operates in order to

qualitatively assess the likelihood of overlap between operation of the fishery and distribution of loggerhead sea turtles.

The *American lobster trap fishery* has been identified as a source of gear causing injuries to and mortality of loggerhead sea turtles as a result of entanglement in buoy lines of the pot/trap gear. Loggerhead sea turtles caught/wrapped in the buoy lines of lobster pot/trap gear can die as a result of forced submergence or incur injuries leading to death as a result of severe constriction of a flipper from the entanglement. Given the seasonal distribution of loggerheads in Mid-Atlantic and New England waters and the operation of the lobster fishery, this species is expected to overlap with the placement of lobster pot/trap gear in the fishery during the months of May through October in waters off of Massachusetts through New Jersey.

American lobsters occur within U.S. waters from Maine to Virginia. They are most abundant from Maine to New Jersey with abundance declining from north to south (ASMFC 1997). Most lobster trap effort occurs in the Gulf of Maine, outside of the action area for this consultation. In 2006, Maine and Massachusetts produced 90% of the total U.S. landings of American lobster, with Maine accounting for 79% of these landings (NMFS 2007b). Lobster landings in the other New England states as well as New York and New Jersey account for most of the remainder of U.S. American lobster landings. However, declines in lobster abundance and landings have occurred from Rhode Island through New Jersey in recent years. The Mid-Atlantic states from Delaware through North Carolina have been granted *de minimus* status under the ASFMC's Interstate Fishery Management Plan (ISFMP). The ISFMP includes measures to constrain or reduce fishing effort in the lobster fishery. Such measures are of benefit to loggerhead sea turtles by reducing the amount of gear (specifically buoy lines) in waters where they also occur.

The most recent Opinion for this fishery, completed on June 14, 2001, concluded that operation of the Federally-regulated portion of the lobster trap fishery may adversely affect loggerhead sea turtles as a result of entanglement in the groundlines and/or buoy lines associated with this type of gear. An ITS was issued with the 2001 Opinion, exempting the annual incidental take (lethal or non-lethal) of 2 loggerhead sea turtles. However, due to new information on the effects of the fishery on North Atlantic right whales and sea turtles, section 7 consultation has been reinitiated.

The *Atlantic bluefish fishery* is known to interact with loggerhead sea turtles, given the time and locations where the fishery occurs. Loggerheads captured in gear used in the bluefish fishery, which includes trawls and gillnets, may die as a result of forced submergence. The majority of commercial bluefish fishing activity in the North and Mid-Atlantic occurs in the late spring to early fall, when bluefish are most abundant in these areas (NEFSC 2006a). This time period also overlaps with the seasonal presence of loggerhead sea turtles in Mid-Atlantic waters north of Cape Hatteras and in New England waters off of Massachusetts, Connecticut, and Rhode Island. Given the seasonality of bluefish fishing activity, operation of the fishery within the action area is expected to overlap the seasonal distribution of loggerhead sea turtles.

The bluefish fishery is managed under Amendment 5 to the Bluefish FMP (NEFSC 2006a). It is not a limited access fishery; however, bluefish landings are controlled through a coastwide quota, with 83% of the quota allocated to the recreational sector and 17% to the commercial

sector (NEFSC 2006a). Effort in the bluefish fishery has declined from a peak of 16.1 million pounds landed in 1981 to 7.1 million pounds landed in 2006 (NMFS 2007c).

Loggerhead captures have been observed in bottom otter trawl gear where bluefish was caught, but constituted less than 50% of the catch (NMFS 1999a). In August 2007, NMFS received an estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the bluefish fishery (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the bluefish fishery was estimated to be 3 loggerhead sea turtles per year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). As of yet, there are no estimates of the annual bycatch of loggerhead sea turtles in gillnet gear used in the bluefish fishery.

The most recent Opinion for this fishery, completed on July 2, 1999, concluded that the Atlantic bluefish fishery may adversely affect loggerhead sea turtles as a result of interactions with the gear associated with this fishery. An ITS was issued with the 1999 Opinion, exempting the annual incidental take of 6 loggerhead sea turtles (of which no more than 3 were anticipated to be lethal). However, due to new information on the effects of the fishery on sea turtles, section 7 consultation has been reinitiated.

The *Atlantic mackerel/squid/butterfish fisheries* are managed under a single FMP that includes both the short-finned squid (*Illex illecebrosus*) and long-finned squid (*Loligo pealei*) fisheries. Loggerhead sea turtles are known to be captured in trawl gear used in the *Loligo* and *Illex* squid fisheries and may be injured or killed as a result of forced submergence in the gear. Bottom otter trawl gear is the primary gear type used to land *Loligo* and *Illex* squid, but several other types of gear may also be used, including hook-and-line, pot/trap, dredge, pound net, and bandit gear. Entanglements or entrapments of loggerhead sea turtles have been recorded in one or more of these gear types. Based on NMFS dealer reports, the majority of *Loligo* and *Illex* squid are fished in the Mid-Atlantic including waters within the action area of this consultation where loggerheads also occur. While squid landings occur year round, the majority of *Loligo* landings occur in the fall through winter months while the majority of *Illex* landings occur from June through October (MAFMC 2007a); time periods that overlap in whole or in part with the distribution of loggerheads in Mid-Atlantic waters.

The most recent Opinion on these fisheries was completed on April 28, 1999. The Opinion concluded that the continued authorization of the FMP was likely to adversely affect loggerhead sea turtles, but not jeopardize their continued existence (NMFS 1999b). An ITS for sea turtles was provided with the Opinion exempting the annual incidental take of up to 6 loggerheads, no more than 3 of which were anticipated to be lethal. In August 2007, NMFS received an estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in these fisheries (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the mackerel, squid, and butterfish fisheries was estimated to be 62 loggerhead sea turtles per year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Due to this new information, NMFS has reinitiated section 7

consultation on the continued authorization of the mackerel, squid, and butterfish fisheries under the Atlantic Mackerel/Squid/Butterfish FMP. That consultation is on-going.

The Federal *monkfish fishery* occurs from Maine to the North Carolina/South Carolina border and is jointly managed by the NEFMC and MAFMC under the Monkfish FMP (NEFSC 2005). A section 7 consultation conducted in 2001 concluded that the operation of the fishery may adversely affect sea turtles, but was not likely to jeopardize their continued existence. In 2003, proposed changes to the Monkfish FMP led to reinitiation of consultation to determine the effects of those actions on ESA-listed species. The resulting biological opinion concluded the continued operation of the fishery under the proposed changes was likely to adversely affect loggerhead sea turtles, but were not likely to jeopardize their continued existence (NMFS 2003a). The ITS issued with the 2003 Opinion exempted the annual incidental take of 3 loggerhead sea turtles in monkfish gillnet gear and one loggerhead in monkfish trawl gear. Although the estimated capture of sea turtles in monkfish gillnet gear is relatively low, there is concern that much higher levels of interaction could occur. Following an event in which over 200 sea turtle carcasses washed ashore in an area where large-mesh gillnetting had been occurring, NMFS published new restrictions preventing the use of gillnets with larger than 8-inch stretched mesh in the EEZ off of North Carolina and Virginia (67 FR 71895, December 3, 2002). The rule was subsequently modified on April 26, 2006 to prohibit the use of gillnets with ≥7-inch (17.9 cm) stretched mesh when fished in Federal waters from the North Carolina/South Carolina border to Chincoteague, Virginia.

In August 2007, NMFS received an estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the monkfish fishery (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the monkfish fishery was estimated to be 2 loggerhead sea turtles a year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). This information represents new information on the capture of loggerhead sea turtles in the monkfish fishery. As a result, NMFS reinitiated formal section 7 consultation on the continued authorization of the monkfish fishery under the Monkfish FMP on April 2, 2008.

The *northeast multispecies fishery* operates throughout the year, with peaks in the spring and from October through February. Multiple gear types are used in the fishery including sink gillnet gear and trawl gear, which are known to be a source of injury and mortality to loggerhead sea turtles as a result of forced submergence from entanglement and capture in the gear (NMFS 2001a). The Northeast multispecies sink gillnet fishery has historically occurred from the periphery of the Gulf of Maine to Rhode Island in waters as deep as 360 feet. In recent years, more of the effort in the fishery has occurred in offshore waters and into the Mid-Atlantic. Participation in this fishery has declined since extensive groundfish conservation measures have been implemented; particularly since implementation of Amendment 13 to the Multispecies FMP in 2004. Additional management measures (*i.e.*, Framework Adjustment 42) are expected to have further reduced effort in the fishery. The exact relationship between multispecies fishing effort and the number of loggerhead interactions with gear used in the fishery is unknown.

However, in general, less fishing effort results in less time that gear is in the water and therefore less opportunity for loggerheads to be captured or entangled in multispecies fishing gear.

The most recent Opinion for the northeast multispecies fishery, completed on June 14, 2001, concluded that operation of the fishery may adversely affect loggerhead sea turtles as a result of entanglement in all gears types associated with this fishery. An ITS was issued with the 2001 Opinion, exempting the annual incidental take (lethal or non-lethal) of 1 loggerhead sea turtle.

In August 2007, NMFS received an estimate of loggerhead sea turtle takes in bottom otter trawl gear used in the northeast multispecies fishery (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the northeast multispecies fishery was estimated to be 43 loggerhead sea turtles per year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). This information represents new information on the capture of loggerhead sea turtles in the northeast multispecies fishery. Therefore, NMFS has reinitiated section 7 consultation on the continued authorization of the multispecies fishery. Section 7 consultation is on-going and will consider the information received from the NEFSC as well as changes to the fishery since 2004.

The *skate fishery* has typically been composed of both a directed fishery and an indirect fishery. The bait fishery is more historical and is a more directed skate fishery than the wing fishery. Otter trawls are the primary gear used to land skates in the U.S., with some landings also coming from sink gillnet, longline, and other gear. For section 7 purposes, NMFS considers the effects to ESA-listed species of the directed skate fishery. Fishing effort that contributes to landings of skate for the indirect fishery is considered during section 7 consultation on the directed fishery in which skate bycatch occurs. Almost the entire directed bait fishery is constrained to two statistical areas, thus this fishery is not widespread around the New England or Mid-Atlantic regions. The directed bait fishery occurs primarily in Federal waters less than 40 fathoms from the Southern Massachusetts/Rhode Island/Connecticut/New York state waters boundary east to the waters south of Martha's Vineyard and Nantucket out to approximately 69EW longitude.

Section 7 consultation on the Northeast Skate Complex FMP was originally completed on July 24, 2003, and concluded that authorization of the skate fishery may adversely affect loggerhead sea turtles as a result of interactions with (capture in) gillnet and trawl gear (NMFS 2003b). However, there have been no recorded takes of loggerhead sea turtles in the skate fishery. Nonetheless, loggerhead sea turtles are expected to be injured and/or killed as a result of capture in gear used in the skate fishery given that: (a) trawl and gillnet gear are used in the fishery, (b) the operation of the fishery overlaps with the distribution of loggerhead sea turtles, and (c) loggerhead sea turtles have been observed captured in trawl and gillnet gear used in other fisheries resulting in death and injury to the sea turtles.

In August 2007, NMFS received an estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the skate fishery (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter

trawl gear used in the skate fishery was estimated to be 24 loggerhead sea turtles per year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). This information represents new information on the capture of loggerhead sea turtles in the skate fishery. NMFS has, therefore, reinitiated section 7 consultation on the continued authorization of the directed skate fishery under the Northeast Skate Complex FMP.

The *spiny dogfish fishery* in the U.S. EEZ is managed under the Spiny Dogfish FMP. The primary gear types for the spiny dogfish fishery are sink gillnets, otter trawls, bottom longline, and driftnet gear (NEFSC 2003). Loggerhead sea turtles can be incidentally captured in all gear sectors of the spiny dogfish fishery, which can lead to injury and/or death as a result of forced submergence in the gear. Dogfish landings have been reported in all months of the year, but most occur from June through September (NEFSC 2003; 2006b). Massachusetts has been the primary state for landings of spiny dogfish since 1979 (NEFSC 2006b).

U.S. landings of spiny dogfish have dropped from 28,000 metric tons (mt) in 1996 to around 1,000 mt in recent years in response to quota restrictions imposed by the Spiny Dogfish FMP and the ASMFC ISFMP (NEFSC 2003, 2006b). In general, a decline in fishing effort is expected to result in a decline in the number of loggerhead captures in the gear since there will be less gear in the water over a shorter period of time. In addition, since the seasonal distribution of loggerheads extends to waters off of Massachusetts, their abundance and the length of time spent in Massachusetts waters is expected to be less than in Mid-Atlantic and southern New England waters. Therefore, the effort reductions in the fishery and the predominance of the fishery in Massachusetts state waters should help to reduce the risk of loggerhead captures in gear used in the spiny dogfish fishery.

NMFS reinitiated section 7 consultation on the Spiny Dogfish FMP on May 4, 2000, to reevaluate, in part, the effects of the spiny dogfish gillnet fishery on sea turtles (NMFS 2001b). The FMP for spiny dogfish called for a 30% reduction in quota allocation levels for 2000 and a 90% reduction in 2001. Although there have been delays in implementing the plan, quota allocations are expected to be substantially reduced over the 4.5 year rebuilding schedule; this should result in a substantial decrease in effort directed at spiny dogfish. As mentioned above, the reduction in effort should be of benefit to loggerheads by reducing the number of gear interactions that occur. As a result, the June 14, 2001 Opinion on the fishery concluded that the authorization of the spiny dogfish fishery under the Spiny Dogfish FMP may adversely affect but is not likely to jeopardize the continued existence of loggerhead sea turtles. An ITS was provided exempting the annual incidental take of 3 loggerheads (no more than 2 lethal) in gear used in the fishery.

The *summer flounder, scup, and black sea bass fisheries* are managed under one FMP. Bottom otter and beam trawl gear are used most frequently in the commercial fisheries for all three species (MAFMC 2007b). Gillnets, handlines, dredges, and pots/traps are also occasionally used (MAFMC 2007b). Effort in the summer flounder, scup, and black sea bass fisheries has declined since the 1980s and since management of each fishery under the FMP. Therefore, the effects to loggerhead sea turtles are expected, in general, to have declined as a result of the decline in fishing effort. Nevertheless, the fisheries primarily operate in Mid-Atlantic waters in areas and

times when loggerhead sea turtles occur. Thus, there is a continued risk of loggerhead sea turtle captures causing injury and/or death in summer flounder, scup, and black sea bass fishing gear.

Section 7 consultation on the summer flounder, scup, and black sea bass FMP was most recently completed on December 16, 2001, and concluded that authorization of the fishery may adversely affect loggerhead sea turtles as a result of interactions with (capture in) trawl and gillnet gear. An ITS was provided for the anticipated incidental capture of up to 19 loggerheads annually (NMFS 2001c). In 2006, the NEFSC released an estimate of loggerhead sea turtle takes in bottom otter trawl gear fished in Mid-Atlantic waters during the period 1996-2004 (Murray 2006). Fifty-percent of the observed 66 takes occurred on vessels targeting summer flounder. However, it should also be noted that some of the observed interactions occurred on vessels fishing with TEDs using an allowed (at that time) TED extension with a minimum 5.5" mesh (Murray 2006). Numerous problems were noted by observers with respect to the mesh used in the TED extension including entanglement of sea turtles in the mesh and blocking of the TED by debris (Murray 2006). NMFS addressed these problems in 1999 by requiring that webbing in the TED extension be no more than 3.5" stretched mesh (Murray 2006). Given these changes, the bycatch rates used for the estimate may be higher than current conditions.

Significant measures have been developed to reduce the incidental take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which includes fisheries for other species like scup and black sea bass). TEDs are required throughout the year for trawl nets fished from the North Carolina/South Carolina border to Oregon Inlet, North Carolina, and seasonally (March 16-January 14) for trawl vessels fishing between Oregon Inlet, North Carolina, and Cape Charles, Virginia.

In August 2007, NMFS received an estimate of loggerhead sea turtle bycatch in bottom otter trawl gear used in the summer flounder, scup, black sea bass fisheries (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). Using VTR data from 2000-2004 and the average annual bycatch of sea turtles as described in Murray (2006), the average annual bycatch of loggerhead sea turtles in bottom otter trawl gear used in the summer flounder, scup, and black sea bass fisheries was estimated to be 200 loggerhead sea turtles per year (Memo from K. Murray, NEFSC to L. Lankshear, NERO, PRD). This represents new information on the capture of loggerhead sea turtles in the summer flounder, scup, and black sea bass fisheries. NMFS has, therefore, reinitiated section 7 consultation on the continued authorization of the summer flounder, scup, and black sea bass fisheries. Consultation is on-going.

4.1.2 Non-Federally regulated fisheries

Nearshore and inshore gillnet fisheries occur throughout the Mid-Atlantic in state waters from Connecticut through North Carolina; areas where sea turtles also occur. Captures of sea turtles in these fisheries have been reported (NMFS SEFSC 2001). Two, 10-14 inch (25.6-35.9 cm) mesh gillnet fisheries, the black drum and sandbar shark gillnet fisheries, occur in Virginia state waters along the tip of the eastern shore. These fisheries may capture or entangle sea turtles given the gear type, but no interactions have been observed. Similarly, small mesh gillnet fisheries occurring in Virginia state waters are suspected of capturing or entangling sea turtles

but no interactions have been observed. In North Carolina, a large-mesh gillnet fishery for summer and southern flounder in the southern portion of Pamlico Sound was found to contribute to captures of sea turtles in gillnet gear. In 2000, an Incidental Take Permit was issued to the North Carolina Department of Marine Fisheries for the incidental take of sea turtles in the Pamlico Sound large-mesh gillnet fishery. The fishery was closed when the incidental take level for green sea turtles was met (NMFS SEFSC 2001). Long haul seines and channel nets are also known to incidentally capture sea turtles in North Carolina sounds and inshore waters. As described in Section 4.4.1 below, NMFS has taken regulatory action to address the potential for sea turtle interactions with gillnet gear with ≥7 inch (17.9 cm) stretched mesh fished in Federal waters off of North Carolina and Virginia.

An *Atlantic croaker fishery* using trawl gear also occurs within the action area. Loggerhead sea turtle captures have been observed in Atlantic croaker trawl gear (Murray 2006). Between 1994 and 2004, observers documented the capture of 18 loggerheads in trawl gear targeting croaker in waters from 41° 30'N/66°W to 35°N/75° 30'W (Murray 2006). Additional observed interactions have occurred with 5 loggerhead captures observed in 2006, 17 captures observed in 2007, and 6 captures observed in 2008 (NEFSC FSB on-line database). NMFS is investigating the use of a TED for trawl gear used in the Atlantic croaker fishery (72 FR 7382).

The *weakfish fishery* occurs in both state and Federal waters but the majority of commercially and recreationally caught weakfish are caught in state waters (ASMFC 2002). The dominant commercial gears include gillnets, pound nets, haul seines, and trawls, with the majority of landings occurring in the fall and winter months (ASMFC 2002). Weakfish landings were dominated by the trawl fishery through the mid-1980s after which gillnet landings began to account for most weakfish landed (ASMFC 2002). North Carolina has accounted for the majority of the annual landings since 1972 while Virginia ranks second, followed by New Jersey (ASMFC 2002). As described in Section 3.1.1, loggerhead sea turtle bycatch in the weakfish fishery has occurred (Murray 2006). Seven of the sixty-six observed loggerhead sea turtle interactions in bottom otter trawl gear fished in Mid-Atlantic waters during the period 1994-2004 were on vessels targeting weakfish. Since observer coverage was low and the fishery uses other gear types known to incidentally take loggerheads, the incidental take of loggerheads in the fishery is likely to have been higher than that which was observed for just the trawl sector.

A *whelk fishery* using pot/trap gear is known to occur in several parts of the action area, including waters off of Connecticut, Massachusetts, Delaware, Maryland, and Virginia. Landings data for Delaware suggest that the greatest effort in the whelk fishery for waters off of that state occurs in the months of July and October; times when loggerhead sea turtles are present. Whelk pots, which unlike lobster traps are not fully enclosed, have been suggested as a potential source of entrapment for loggerhead sea turtles that may be enticed to enter the trap to get the bait or whelks caught in the trap (Mansfield *et al.* 2001).

Various *crab fisheries*, such as horseshoe crab and blue crab, also occur in Federal and state waters. The crab fisheries may have detrimental impacts on loggerhead sea turtles beyond entanglement in the fishing gear itself. Loggerheads are known to prey on crab species, including horseshoe and blue crabs. In a study of the diet of loggerhead sea turtles in Virginia

waters from 1983-2002, Seney and Musick (2007) found a shift in the diet of loggerheads in the area from horseshoe and blue crabs to fish, particularly menhaden and Atlantic croaker. The authors suggested that a decline in the crab species has resulted in the shift and loggerheads are likely foraging on fish captured in fishing nets or on discarded fishery bycatch (Seney and Musick 2007). The physiological impacts of this shift are uncertain although it was suggested as a possible explanation for the declines in loggerhead abundance noted by Mansfield (2006). Other studies have detected seasonal declines in loggerhead abundance coincident with seasonal declines of horseshoe and blue crabs in the same area (Maier *et al.* 2005). While there is no evidence of a decline in horseshoe crab abundance in the southeast during the period 1995-2003, declines were evident in some parts of the Mid-Atlantic (ASMFC 2004; Eyler *et al.* 2007). Given the variety of loggerheads prey items (Dodd 1988; Burke *et al.* 1993; Bjorndal 1997; Morreale and Standora 1998) and the differences in regional abundance of horseshoe crabs and other prey items (ASMFC 2004; Eyler *et al.* 2007), a direct correlation between loggerhead sea turtle abundance and horseshoe crab and blue crab availability cannot be made at this time. Nevertheless, the decline in loggerhead abundance in Virginia waters (Mansfield 2006), and possibly Long Island waters (Morreale *et al.* 2005), commensurate with noted declines in the abundance of horseshoe crabs and other crab species raises concerns that crab fisheries may be significantly impacting the forage base for loggerheads in some areas of their range.

Observations of state recreational fisheries have shown that loggerhead sea turtles are known to bite and frequently ingest baited hooks. Hooked loggerhead sea turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties, and from commercial fishermen fishing for snapper, grouper, and sharks with both single rigs and bottom longlines (NMFS SEFSC 2001). A summary of known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the TEWG (1998, 2000) reports.

4.2 Vessel Activity and Military Operations

Potential sources of adverse effects from Federal vessel operations in the action area include operations of the U.S. Navy (USN) and Coast Guard (USCG), the Environmental Protection Agency (EPA), the Army Corps of Engineers (ACOE), and NOAA. NMFS has conducted formal consultations with the USCG, the USN, and NOAA on their vessel operations. Through the section 7 process, where applicable, NMFS has and will continue to establish conservation measures for all these agency vessel operations to avoid or minimize adverse effects to loggerhead sea turtles. At the present time, however, there is the potential for some level of interaction. Refer to the biological opinions for the USCG (NMFS 1995) and the USN (NMFS 1997) for details on the scope of vessel operations for these agencies in the action area and vicinity and conservation measures being implemented as standard operating procedures.

The USN consultation only covered operations out of Mayport, Florida, although the potential exists for USN vessels to adversely affect loggerheads when they are operating in other areas within the range of the species. Similarly, operations of vessels by other Federal agencies within the action area (NOAA, EPA, ACOE) may also adversely affect loggerheads. However, the in-water activities of those agencies are limited in scope, as they operate a limited number of

vessels or are engaged in research/operational activities that are unlikely to contribute a large amount of risk.

Additional activities including ordnance detonation also affect loggerhead sea turtles. Section 7 consultations were conducted for USN aerial bombing training in the ocean off the southeast U.S. coast, involving drops of live ordnance (500 and 1,000-lb bombs) (NMFS 1997) and the operation of the USCG's boats and cutters in the U.S. Atlantic (NMFS 1995). These consultations determined that each activity was likely to adversely affect loggerheads but would not jeopardize their continued existence. An ITS was issued for each activity. USN aerial bombing training activities were estimated to have the potential to injure or kill 84 loggerheads annually (NMFS 1997). Operation of the USCG's boats and cutters in the U.S. Atlantic, meanwhile, was estimated to take no more than one loggerhead sea turtle per year (NMFS 1995).

4.3 Other Activities

4.3.1 Hopper Dredging

The construction and maintenance of Federal navigation channels and sand mining ("borrow") areas have also been identified as sources of loggerhead sea turtle mortality. Hopper dredges move rapidly compared to loggerhead swimming speeds and can entrain and kill loggerheads, presumably as the drag arm of the moving dredge overtakes the slower moving sea turtle.

The Sandbridge Shoal is an approved Minerals Management Service borrow site located approximately 3 miles off Virginia Beach. This site has been used in the past for both the Navy's Dam Neck Annex beach renourishment project and the Sandbridge Beach Erosion and Hurricane Protection Project, and is likely to be used in additional beach nourishment projects in the future. The Sandbridge Beach Erosion and Hurricane Protection Project involved hopper dredging of approximately 972,000 cubic yards (cy) of sand during the first year of the project and an anticipated 500,000 cy every two years thereafter. NMFS completed section 7 consultation on this project in April 1993, and anticipated the incidental take of eight loggerhead sea turtles. Actual dredging did not begin until May 1998, and no loggerhead interactions were observed during the 1998 dredge cycle. In June 2001, the ACOE indicated that the next dredge cycle, which was scheduled to begin in the summer of 2002, would require 1.5 million cy of sand initially, with an anticipated 1.1 million cy every two years thereafter. Although the volume of sand had increased from the previous cycle, NMFS reduced the ITS to five loggerheads due to the lack of observed interactions in the previous cycle, along with the levels of anticipated and observed incidental take in hopper dredging projects in nearby locations.

NMFS completed section 7 consultation on the Navy's Dam Neck Annex beach nourishment project in January 1996, which involved the removal of 635,000 cy of material beginning in 1996 and continuing on a 12-year cycle thereafter. NMFS anticipated the incidental take of ten loggerheads during each dredge cycle. However, no interactions were observed during the 1996 cycle. The Navy reinitiated consultation on June 27, 2003, based on an accelerated dredge cycle (from 12 years to 8 years), an increase in the volume of sand required, and new information on the status of loggerhead sea turtles since the original Opinion was issued in 1996. The

consultation was concluded on December 12, 2003, and anticipated the incidental take of four loggerheads during each dredge cycle. NMFS concluded that this level of incidental take was not likely to jeopardize the continued existence of loggerhead sea turtles.

4.3.2 Maritime Industry

Private and commercial vessels, including fishing vessels, operating in the action area of this consultation also have the potential to interact with loggerhead sea turtles. The effects of fishing vessels, recreational vessels, or other types of commercial vessels on loggerheads may involve disturbance or injury/mortality due to collisions or entanglement in anchor lines. It is important to note that minor vessel collisions may not kill an individual directly, but may weaken or otherwise affect it so it is more likely to become vulnerable to effects such as entanglements. Loggerheads may also be affected by fuel oil spills resulting from vessel accidents. Fuel oil spills could affect loggerheads through the food chain. Fuel spills involving fishing vessels are common events. However, these spills typically involve small amounts of material that are unlikely to adversely affect loggerheads. Larger oil spills may result from accidents, although these events would be rare and involve small areas. No direct adverse effects on loggerhead sea turtles resulting from fishing vessel fuel spills have been documented.

4.3.3 Pollution

Anthropogenic sources of marine pollution, while difficult to attribute to a specific Federal, state, local, or private action, may affect loggerhead sea turtles in the action area. Sources of pollutants in the action area include atmospheric loading of pollutants such as PCBs; storm water runoff from coastal towns, cities, and villages; runoff into rivers emptying into bays; groundwater discharges; sewage treatment plant effluents; and oil spills. The pathological effects of oil spills on sea turtles have been documented in several laboratory studies (Vargo *et al.* 1986).

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effect to larger embayments is unknown. Contaminants could degrade habitat if pollution and other factors reduce the food available to marine animals.

4.3.4 Coastal development

Beachfront development, lighting, and beach erosion control are all ongoing activities along the Mid-Atlantic and southern New England coasts of the U.S. These activities potentially reduce or degrade loggerhead sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage loggerheads from nesting sites. The extent to which these activities reduce sea turtle nesting and hatchling production is unknown. However, more and more coastal counties are adopting stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting.

4.3.5 Global climate change and ocean acidification

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities—frequently referred to in layman's terms as "global warming." Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The EPA's climate change webpage (http://www.epa.gov/climatechange/index.html) provides background information on these and other measured or anticipated effects. Activities in the action area that may have contributed to global warming include the combustion of fossil fuels by vessels.

The effects of global climate change are typically viewed as being detrimental to loggerhead sea turtles (NMFS and USFWS 2007). Changes in water temperature would be expected to affect prey distribution and/or abundance, salinity, and water circulation patterns perhaps even to the extent that the Gulf Stream in the Atlantic is disrupted (Gagosian 2003; NMFS and USFWS 2007). The effects of these on loggerheads cannot, for the most part, be accurately predicted at this time. However, several studies have investigated the effects of changes in sea surface temperature and air temperatures on sea turtle reproductive behavior. For loggerhead sea turtles, warmer sea surface temperatures in the spring have been correlated to an earlier onset of nesting (Weishampel *et al.* 2004; Hawkes *et al.* 2007), shorter internesting intervals (Hays *et al.* 2002), and a decrease in the length of the nesting season (Pike *et al.* 2006).

Air temperatures also play a role in sea turtle reproduction. In marine turtles, sex is determined by temperatures in the middle third of the incubation period with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Based on modeling, a 2°C increase in air temperature is expected to result in a sex ratio of over 80% female offspring for loggerhead nesting beaches in the vicinity of Southport, NC. Farther to the south at Cape Canaveral, FL, a 2°C increase in air temperature would likely result in production of 100% females while a 3°C increase in air temperature would likely exceed the thermal threshold of sea turtle clutches resulting in death (Hawkes *et al.* 2007). Thus, changes in air temperature as a result of global climate change may alter sex ratios and may reduce hatchling production in the most southern nesting areas of the U.S. Given that the south Florida nesting group is the largest loggerhead nesting group in the Atlantic (in terms of nests laid), a decline in the success of nesting as a result of global climate change could have profound effects on the abundance and distribution of loggerhead sea turtles in the Atlantic.

While the type and extent of effects to loggerhead sea turtles as a result of global climate change are still speculative, a disruption of the Gulf Stream, such as might occur as a result of global climate change (Gagosian 2003), would be expected to have profound effects on every aspect of loggerhead sea turtle life history including hatching success, oceanic migrations at all life stages, foraging, and nesting.

Ocean acidification related to global warming would also reasonably be expected to negatively affect loggerhead sea turtles. The term "ocean acidification" describes the process of ocean water becoming corrosive as a result of carbon dioxide (CO_2) being absorbed from the atmosphere. The absorption of atmospheric CO_2 into the ocean lowers the pH of the waters.

Evidence of corrosive water caused by the ocean's absorption of CO_2 was found less than 20 miles off the west coast of North America during a field study from Canada to Mexico in the summer of 2007 (Feely *et al.* 2008). This was the first time "acidified" ocean water was found on the continental shelf of western North America. While the ocean's absorption of CO_2 provides a great service to humans by significantly reducing the amount of greenhouse gases in the atmosphere and decreasing the effects of global warming, the resulting change in ocean chemistry could adversely affect marine life, particularly organisms with calcium carbonate shells such as corals, mussels, mollusks, and small creatures in the early stages of the food chain (*e.g.*, plankton). A number of these organisms serve as important prey items for loggerheads.

4.4 Reducing Threats to Loggerhead Sea Turtles

NMFS has implemented a series of regulations aimed at reducing the potential for incidental mortality of loggerhead sea turtles from commercial fisheries in the action area, and other measures to contribute to the recovery of the species. These include sea turtle release gear requirements for Atlantic HMS; TED requirements for U.S. south Atlantic and Gulf of Mexico shrimp trawl and North Carolina flynet fisheries; mesh size restrictions in the North Carolina gillnet fishery and Virginia's gillnet and pound net fisheries; and area closures in the North Carolina gillnet fishery. In addition to regulations, outreach programs have been established and data on sea turtle interactions with recreational fisheries has been collected through the Marine Recreational Fishing Statistical Survey (MRFSS). The summaries below discuss all of these measures in more detail. While some of these actions occur outside of the action area for this consultation, the measures affect loggerhead sea turtles that do occur within the action area.

4.4.1 Final Rules for Large-Mesh Gillnets

In March 2002, NMFS published new restrictions for the use of gillnets with larger than 8-inch (20.3 cm) stretched mesh, in Federal waters (3-200 nautical miles) off of North Carolina and Virginia. These restrictions were published in an interim final rule under the authority of the ESA (67 FR 13098) and were implemented to reduce the impact of the monkfish and other large-mesh gillnet fisheries on ESA-listed sea turtles in areas where sea turtles are known to concentrate. Following review of public comments submitted on the interim final rule, NMFS published a final rule on December 3, 2002, that established the restrictions on an annual basis. As a result, gillnets with larger than 8-inch (20.3 cm) stretched mesh were not allowed in Federal waters (3-200 nautical miles) in the areas described as follows: (1) North of the North Carolina/South Carolina border at the coast to Oregon Inlet at all times; (2) north of Oregon Inlet to Currituck Beach Light, NC from March 16 through January 14; (3) north of Currituck Beach Light, NC, to Wachapreague Inlet, VA, from April 1 through January 14; and (4) north of Wachapreague Inlet, VA, to Chincoteague, VA, from April 16 through January 14. On April 26, 2006, NMFS published a final rule (71 FR 24776) that included modifications to the large-mesh gillnet restrictions. The new final rule revised the gillnet restrictions to apply to stretched mesh that is ≥7 inches (17.9 cm). Federal waters north of Chincoteague, VA, remain unaffected by the large-mesh gillnet restrictions. These measures are in addition to Harbor Porpoise Take Reduction Plan measures that prohibit the use of large-mesh gillnets in southern Mid-Atlantic waters (territorial and Federal waters from Delaware through North Carolina out to 72E 30'W

longitude) from February 15 through March 15, annually. The measures are also in addition to comparable North Carolina and Virginia regulations for large-mesh gillnet fisheries in their respective state waters that were enacted in 2005.

NMFS has also issued a rule addressing capture of sea turtles in gillnet gear fished in the southern flounder fishery in Pamlico Sound. NMFS issued a final rule (67 FR 56931), effective September 3, 2002, that closed the waters of Pamlico Sound, NC, to fishing with gillnets with larger than 4 ¼-inch (10.8 cm) stretched mesh from September 1 through December 15 each year to protect migrating sea turtles. The closed area includes all inshore waters of Pamlico Sound south of 35E 46.3' N. lat., north of 35E00' N. lat., and east of 76E 30' W. long.

4.4.2 TED requirements for the summer flounder fishery

As mentioned in Section 4.1.1, significant measures have been developed to reduce the incidental take of sea turtles in summer flounder trawls and trawls that meet the definition of a summer flounder trawl (which would include fisheries for other species like scup and black sea bass) by requiring TEDs in trawl nets fished in trawls used in the area of greatest sea turtle bycatch off the North Carolina and part of the Virginia coast from North Carolina/South Carolina border to Cape Charles, VA. The TED requirements for the summer flounder trawl fishery do not, however, require the use of larger TEDs that are required to be used in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries.

4.4.3 HMS Sea Turtle Protection Measures

NMFS completed the most recent biological opinion on the FMP for the Atlantic HMS fisheries for swordfish, tuna, and sharks on June 1, 2004, and concluded that the pelagic longline component of the fishery was likely to jeopardize the continued existence of leatherback sea turtles. An RPA was provided to avoid jeopardy to leatherback sea turtles as a result of the operation of this component of the fishery. The RPA is also expected to benefit loggerhead sea turtles by reducing the likelihood of mortality resulting from interactions with the gear. Regulatory components of the RPA have been implemented through rulemaking.

4.4.4 Sea Turtle Handling and Resuscitation Techniques

NMFS has developed and published as a final rule in the *Federal Register* (66 FR 67495, December 31, 2001) sea turtle handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled sea turtles caught in fishing or scientific research gear.

4.4.5 Sea Turtle Entanglements and Rehabilitation

A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the USFWS, the U.S. Coast Guard, or any other Federal land or water management agency, or

any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA (50 CFR 223.206(b)).

4.4.6 Education and Outreach Activities

Education and outreach activities do not directly reduce the threats to loggerhead sea turtles. However, education and outreach are a means of better informing the public of steps that can be taken to reduce impacts to loggerheads (*i.e.*, reducing light pollution in the vicinity of nesting beaches) and increasing communication between affected user groups (*e.g.*, the fishing community). For the HMS fishery, NMFS has been active in public outreach to educate fishermen regarding sea turtle handling and resuscitation techniques. For example, NMFS has conducted workshops with longline fishermen to discuss bycatch issues including protected species, and to educate them regarding handling and release guidelines. NMFS intends to continue these outreach efforts in an attempt to increase the survival of protected species through education on proper release techniques.

4.4.7 Sea Turtle Stranding and Salvage Network (STSSN)

As is the case with education and outreach, the STSSN does not directly reduce the threats to loggerhead sea turtles. However, the extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts not only collects data on dead sea turtles, but also rescues and rehabilitates live stranded sea turtles. Data collected by the STSSN are used to monitor stranding levels and identify areas where unusual or elevated mortality is occurring. These data are also used to monitor incidence of disease, study toxicology and contaminants, and conduct genetic studies to determine population structure. All of the states that participate in the STSSN tag live sea turtles when encountered (either via the stranding network through incidental takes or in-water studies). Tagging studies help provide an understanding of sea turtle movements, longevity, and reproductive patterns, all of which contribute to our ability to reach recovery goals for the species.

5.0 CUMULATIVE EFFECTS

Cumulative effects include the effects in the action area of future State, tribal, local or private actions that are reasonably certain to occur. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Sources of human-induced mortality, injury, and/or harassment of loggerhead sea turtles in the action area that are reasonably certain to occur in the future include incidental takes in state-regulated fishing activities, vessel collisions, ingestion of plastic debris, and pollution. While the

combination of these activities may affect loggerhead sea turtle populations, preventing or slowing the species' recovery, the magnitude of these effects is currently unknown.

State Water Fisheries - Fishing activities are considered one of the most significant causes of death and serious injury for sea turtles. The NRC (1990) report estimated that 550 to 5,500 sea turtles (juvenile and adult loggerheads and Kemp's ridleys) die each year from all other fishing activities besides shrimp fishing. Fishing gear in state waters, including bottom trawls, gillnets, trap/pot gear, and pound nets, incidentally takes sea turtles each year. NMFS is working with state agencies to address the incidental take of sea turtles in state water fisheries within the action area of this consultation where information exists to show that these fisheries incidentally take sea turtles. Action has been taken by some states to reduce or remove the likelihood of sea turtle interactions in one or more gear types. However, given that state managed commercial and recreational fisheries along the Atlantic coast are reasonably certain to occur within the action area in the foreseeable future, additional incidental takes of sea turtles in these fisheries are anticipated. There is insufficient information by which to quantify the number of incidental takes presently occurring as a result of state water fisheries as well as the number of sea turtles injured or killed as a result of such incidental takes. While actions have been taken to reduce incidental takes in some state water fisheries, the overall effect of these actions on reducing the incidental take of sea turtles in state water fisheries is unknown, and the future effects of state water fisheries on sea turtles cannot be quantified. Further information on past effects of state water fisheries on sea turtles is available in Section 4.1.2.

Vessel Interactions - NMFS STSSN data indicate that vessel interactions are responsible for a large number of loggerhead sea turtle strandings within the action area each year. Such collisions are reasonably certain to continue into the future. Collisions with boats can stun or easily kill loggerhead sea turtles, and many stranded individuals have obvious propeller or collision marks (Dwyer *et al.* 2003). However, it is not always clear whether the collision occurred pre- or post-mortem. As a result an estimate of the number of loggerhead sea turtles that will likely be killed by vessels is not possible.

Pollution and Contaminants - Human activities causing pollution are reasonably certain to continue in the future, as are impacts from them on loggerhead sea turtles in the action area. However, the level of impacts cannot be projected. Marine debris (*e.g.*, discarded fishing line or lines from boats) can entangle loggerheads in the water and drown them. Loggerheads commonly ingest plastic or mistake debris for food. Chemical contaminants may also have an effect on loggerhead sea turtle reproduction and survival. Excessive turbidity due to coastal development and/or construction sites could influence loggerhead foraging ability. As mentioned previously, loggerheads are not very easily affected by changes in water quality or increased suspended sediments, but if these alterations make habitat less suitable for them and hinder their capability to forage, eventually they would tend to leave or avoid these less desirable areas (Ruben and Morreale 1999). Noise pollution has been raised, primarily, as a concern for marine mammals but may be a concern for other marine organisms, including loggerhead sea turtles. As described above, global warming is likely to negatively affect loggerheads – affecting when females lay their eggs, the survival of the eggs, sex ratios of offspring, and the stability of the Gulf Stream. To the extent that air pollution, for example from the combustion of fossil fuels

by vessels, contributes to global warming, then it is also expected to negatively affect loggerhead sea turtles in the action area.

5.1 Summary and Synthesis of the Status of Species, Environmental Baseline, and Cumulative Effects sections

This section synthesizes the *Status of the Species*, the *Environmental Baseline*, and *Cumulative Effects* sections as best as possible given that some information on loggerhead sea turtles is quantified, yet much remains qualitative or unknown. The *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections, taken together, establish a "baseline" that is used to determine whether the Spring and Fall 2009 NEAMAP Near Shore Trawl Surveys to be conducted by VIMS and funded by NMFS under the 2009 Mid-Atlantic RSA program (RSA project 09-MID-02) is likely to jeopardize the continued existence of loggerhead sea turtles.

The loggerhead sea turtle is a threatened species, meaning that it is likely to become an endangered species in the foreseeable future throughout all or a significant portion of its range. For purposes of this Opinion, NMFS considers the trend for loggerheads to be declining. This trend is the result of past, present, and likely future human activities and natural events, some effects of which are positive, some negative, and some unknown, as discussed previously in the *Status of the Species*, *Environmental Baseline*, and *Cumulative Effects* sections taken together. Additional information is provided below.

Loggerhead Sea Turtles. Loggerhead sea turtles are listed as a single species classified as "threatened" under the ESA. Loggerhead nesting occurs on beaches of the Pacific, Indian, and Atlantic Oceans, and the Mediterranean Sea. Genetic analyses of maternally inherited mitochondrial DNA demonstrate the existence of separate, genetically distinct nesting groups between as well as within the ocean basins (TEWG 2000; Bowen and Karl 2007).

It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 1991). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in Sections 3.1 and 4.0, negative impacts causing death of various age classes occur both on land and in the water. In addition, given the distances traveled by loggerheads in the course of their development, actions to address the negative impacts require the work of multiple countries at both the national and international level (NMFS and USFWS 2007). Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, many remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

There are no population estimates for loggerhead sea turtles. Sea turtle nesting data, in terms of the number of nests laid each year, is collected for loggerhead sea turtles for at least some nesting beaches within each of the ocean basins and the Mediterranean Sea. From this, the number of reproductively mature females utilizing those nesting beaches can be estimated based on the presumed remigration interval and the average number of nests laid by a female

loggerhead sea turtle per season. These estimates provide a minimum count of the number of loggerhead sea turtles in any particular nesting group. The estimates do not account for adult females who nest on beaches with no or little survey coverage, and do not account for adult males or juveniles of either sex. The proportion of adult males to females from each nesting group, and the age structure of each loggerhead nesting group is currently unknown. For these reasons, nest counts cannot be used to estimate the total population size of a nesting group and, similarly, trends in the number of nests laid cannot be used as an indicator of the population trend (whether decreasing, increasing or stable) (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005; letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007).

Nevertheless, nest count data are a valuable source of information for each loggerhead nesting group and for loggerheads as a species since the number of nests laid reflect the reproductive output of the nesting group each year, and also provide insight on the contribution of each nesting group to the species. Based on a comparison of the available nesting data, the world's largest known loggerhead nesting group (in terms of estimated number of nesting females) occurs in Oman in the northern Indian Ocean, where an estimated 20,000-40,000 females nest each year (Baldwin *et al.* 2003). The world's second largest known loggerhead nesting group, the PFRU, occurs along the southeast coast of the U.S. from the Florida/Georgia border through Pinellas County on Florida's west coast, where approximately 15,735 females nest per year (based on a mean of 64,513 nests laid per year from 1989-2007; NMFS and USFWS 2008). The world's third largest loggerhead nesting group also occurs in the U.S., from the Florida/Georgia border through southern Virginia. However, the approximate number of females nesting annually is 1,272 (based on a mean number of 5,215 nests laid per year from 1989-2008; NMFS and USFWS 2008), which is less than 1/10th the size of the PFRU. Thus, while loggerhead nesting occurs at multiple sites within multiple ocean basins and the Mediterranean Sea, the extent of nesting is disproportionate amongst the various sites and only two geographic areas, Oman and peninsular Florida, account for the majority of nesting for the species worldwide.

Declines in loggerhead nesting have been noted at nesting beaches throughout the range of the species. These include nesting for the PFRU – the second largest loggerhead nesting group in the world and the largest of all of the loggerhead nesting groups in the Atlantic (Meylan *et al.* 2006; NMFS and USFWS 2008). A final revised recovery plan for loggerhead sea turtles in the northwest Atlantic Ocean was recently published by NMFS and FWS in December 2008. This document is a second revision to the original recovery plan that was approved in 1984 and most recently revised in 1991 (NMFS and USFWS 1991). The final revised plan reviews and discusses the species' ecology, population status and trends, and identifies the many threats to loggerhead sea turtles in the Northwest Atlantic Ocean. It lays out a recovery strategy to address the threats, based on the best available science, and includes recovery goals and criteria. In addition, the plan identifies substantive actions needed to address the threats to the species and achieve recovery.

In light of the above, for purposes of this Opinion, NMFS considers the trend for loggerheads as a species to be declining. NMFS recognizes that the available nest count data only provides information on the number of females currently nesting, and is not necessarily a reflection of the

number of mature females available to nest or the number of immature females that will reach maturity and nest in the future. Also, the trend in the number of nests laid is not a reflection of the overall trend in any nesting group given that the proportion of adult males to females, and the age structure of each loggerhead nesting group is currently unknown. This determination that the trend for loggerheads as a species is declining provides benefit of the doubt to the species given its threatened classification under the ESA, the many on-going negative impacts to the species across all areas of its range and to all age classes, and information to suggest that fewer nests are being laid (potentially reducing the number of offspring that will mature and contribute to the species' continued existence).

6.0 EFFECTS OF THE ACTION

As discussed in the *Description of the Proposed Action*, the proposed Federal action is the Spring and Fall 2009 NEAMAP Near Shore Trawl Surveys to be funded by NMFS's allocation of pounds of summer flounder, scup, black sea bass, bluefish, and *Loligo* squid to VIMS under the 2009 Mid-Atlantic RSA Program. The Spring and Fall 2009 NEAMAP surveys will use bottom otter trawl gear in areas and at times when loggerhead sea turtles are also likely to be present. As described in Section 1.0, NMFS has determined that the use of trawl gear for the Spring and Fall 2009 NEAMAP surveys may adversely affect loggerhead sea turtles as a result of capture in the trawl gear. Given that determination, section 7 of the ESA requires NMFS to further determine whether the use of trawl gear for the Spring and Fall 2009 NEAMAP surveys is likely to jeopardize the continued existence of ESA-listed loggerhead sea turtles and to present its conclusion in this Opinion. Section 6.0, therefore, examines the likely effects of the Spring and Fall 2009 NEAMAP surveys on ESA-listed loggerhead sea turtles within the action area in order for NMFS to make a final determination as to whether the proposed action will jeopardize the continued existence of this species, overall.

6.1 Approach to the Assessment

Sea turtles are known to be injured and/or killed as a result of being struck by vessels on the water and as a result of capture in or physical contact with fishing gear. Loggerhead sea turtles may also be negatively affected by the loss of prey as a result of mobile fishing gear that removes or incidentally kills such prey during commercial fishing or marine survey activities.

With respect to the Spring and Fall 2009 NEAMAP surveys, the effects to loggerhead sea turtles as a result of vessel activities are discountable. The single vessel that will operate on the water as a result of the proposed action is unlikely to strike loggerhead sea turtles in the action area given that: (a) the vessel will operate/travel at a slow speed such that a loggerhead would have the speed and maneuverability to avoid contact with the vessel and (b) loggerhead sea turtles spend part of their time at depths out of range of a vessel collision.

The use of bottom otter trawl gear for the survey is expected to have an insignificant effect on loggerhead prey or the bottom habitat utilized by loggerhead sea turtles. The trawl tows to be conducted during the study are limited in both scope and duration. Those organisms which are captured in the gear will, with the exception of a sampling, be returned to the water. While some

of these may be returned to the water dead or injured to the extent that the organisms will shortly die, they would still be available as prey for loggerhead sea turtles which are known to eat a variety of live prey as well as scavenge dead organisms (Keinath *et al.* 1987; Lutcavage and Musick 1985; Dodd 1988; Burke *et al.* 1993; Morreale and Standora 2005). With respect to the effect of the survey tows on bottom habitat, the area to be surveyed is principally sand substrate (NEFMC 2007). A panel of experts has previously concluded that the effects of even light weight otter trawl gear would include: (1) the scraping or plowing of the doors on the bottom, sometimes creating furrows along their path, (2) sediment suspension resulting from the turbulence caused by the doors and the ground gear on the bottom, (3) the removal or damage to benthic or demersal species, and (4) the removal or damage to structure forming biota. The panel also concluded that the greatest impacts from otter trawls occur in high and low energy gravel habitats and in hard clay outcroppings, and that sand habitats were the least likely to be impacted (NREFHSC 2002). The areas to be surveyed for the Spring and Fall 2009 NEAMAP surveys include very few habitats that are purely gravel or hard clay—so few that the area encompassed by these habitats is insignificant compared to the area encompassed by sand and silt type habitats, which are more resilient to bottom trawling. For sea turtles, the effects on habitat due to bottom otter trawl gear would be felt as an effect on their benthic prey species. As stated above, the effects on sea turtle prey items are expected to be insignificant. The remainder of this section focuses on the effects to loggerhead sea turtles as a result physical contact with (capture in) bottom otter trawl that will be used for the survey.

No loggerhead sea turtle captures were documented in the trawl gear used during the Fall 2006 NEAMAP pilot trawl survey or the Fall 2008 NEAMAP survey. Loggerheads have, however, been captured in trawl gear used by the NEFSC for their spring and fall surveys of Mid-Atlantic and New England waters. Loggerheads have also been captured in bottom otter trawl gear used in commercial fishing operations in Mid-Atlantic and New England waters. In order to identify, describe, and assess the effects to loggerheads resulting from the use of bottom otter trawl survey gear for the Spring and Fall 2009 NEAMAP surveys, NMFS is, therefore, using: (1) information on captures of loggerheads in NEFSC trawl surveys and NMFS observed commercial fishing operations, (2) information on the description and operation of bottom otter trawl gear, (3) life history information for loggerheads, and (4) the effects of fishing gear entanglements on sea turtles that has been published in a number of documents. These documents include sea turtle status reviews and biological reports (NMFS and USFWS 1995, 2007; NMFS SEFSC 2001; TEWG 1998, 2000), the loggerhead recovery plans (NMFS and USFWS 1991, 2008), and numerous other sources of information from the published literature as cited below.

6.1.1 Description of the Trawl Gear

Bottom otter trawls are comprised of a net to catch the target species, and doors attached to two cables that are used to keep the mouth of the net open while deployed (NEFMC 2003). A sweep runs along the bottom of the net mouth (NEFMC 2003). Depending on the bottom type and species targeted, the sweep may be configured with chains, "cookies" (small rubber disks), or larger rubber disks (rock-hoppers or roller gear) that help to prevent the net from snagging on bottom that contains rocks or other structures (NREFHSC 2002; NEFMC 2003). The bottom trawl that will be used in the Spring and Fall 2009 NEAMAP surveys is described as follows:

- a three bridle, four seam design with varying mesh sizes in different panels;
- the net has a 2.4 inch stretch mesh in the body and codend, a 4.8 inch stretch mesh in the wings, and a 1 inch stretch mesh in the codend liner;
- the headrope length is 77 ft;
- the footrope length is 87 ft;
- approximately 60, 8 inch HD center hole plastic floats will be used;
- two different sweeps will be used for use on rough versus "good" bottom;
- the rough bottom sweep has 16 and 14 inch rock hoppers with floppies without leads and weighs 2,560 and 448 pounds in air and water, respectively; and,
- the "good bottom" sweep consists of 3 inch rubber discs, and weighs 643 and 371 pounds in air and water, respectively (VIMS 2008).

6.1.2 Effects to Sea Turtles from Capture in Trawl Gear

Sea turtles forcibly submerged in any type of restrictive gear eventually suffer fatal consequences from prolonged anoxia and/or seawater infiltration of the lung (Lutcavage *et al.* 1997). A study examining the relationship between tow time and sea turtle mortality in the shrimp trawl fishery showed that mortality was strongly dependent on trawling duration, with the proportion of dead or comatose sea turtles rising from 0% for the first 50 minutes of capture to 70% after 90 minutes of capture (Henwood and Stuntz 1987). However, metabolic changes that can impair a sea turtle's ability to function can occur within minutes of a forced submergence. While most voluntary dives appear to be aerobic, showing little if any increases in blood lactate and only minor changes in acid-base status, the story is quite different in forcibly submerged sea turtles, where oxygen stores are rapidly consumed, anaerobic glycolysis is activated, and acid-base balance is disturbed, sometimes to lethal levels (Lutcavage and Lutz 1997). Forced submergence of Kemp's ridley sea turtles in shrimp trawls resulted in an acid-base imbalance after just a few minutes (times that were within the normal dive times for the species) (Stabenau *et al.* 1991). Conversely, recovery times for acid-base levels to return to normal may be prolonged. Henwood and Stuntz (1987) found that it took as long as 20 hours for the acid-base levels of loggerhead sea turtles to return to normal after capture in shrimp trawls for less than 30 minutes. This effect is expected to be worse for sea turtles that are recaptured before metabolic levels have returned to normal.

Following the recommendations of the NRC to reexamine the association between tow times and sea turtle deaths, the data set used by Henwood and Stuntz (1987) was updated and re-analyzed (Epperly *et al.* 2002; Sasso and Epperly 2006). Seasonal differences in the likelihood of mortality for sea turtles caught in trawl gear were apparent. For example, the observed mortality exceeded 1% after 10 minutes of towing in the winter (defined in Sasso and Epperly (2006) as the months of December-February), while the observed mortality did not exceed 1% until after 50 minutes in the summer (defined as March-November; Sasso and Epperly 2006). In general, tows of short duration (<10 minutes) in either season have little effect on the likelihood of mortality for sea turtles caught in the trawl gear and would likely achieve a negligible mortality rate (defined by the NRC as <1%). Intermediate tow times (10-200 minutes in summer and 10-150 minutes in winter) result in a rapid escalation of mortality, and eventually reach a plateau of

high mortality, but will not equal 100%, as a sea turtle caught within the last hour of a long tow will likely survive (Epperly *et al.* 2002; Sasso and Epperly 2006). However, in both seasons, a rapid escalation in the mortality rate did not occur until after 50 minutes (Sasso and Epperly 2006) as had been found by Henwood and Stuntz (1987). Although the data used in the reanalysis were specific to bottom otter trawl gear in the U.S. south Atlantic and Gulf of Mexico shrimp fisheries, the authors considered the findings to be applicable to the impacts of forced submergence in general (Sasso and Epperly 2006).

During spring and fall bottom otter trawl surveys conducted by the NEFSC from 1963-2008, a total of 71 loggerhead sea turtles were observed captured. Only one of the 71 loggerheads suffered injuries (cracks to the carapace) causing death (Wendy Teas, SEFSC, pers. comm. to Linda Despres, NEFSC, 2007). All others were alive and returned to the water unharmed. NEFSC trawl survey tows are approximately 30 minutes in duration. In contrast, commercial fisheries typically tow bottom otter trawl gear in excess of one hour (Murray 2006). Of the 91 documented loggerhead interactions with commercial bottom otter trawl gear from January 1994 to February 2007, 54 (59%) were alive and uninjured, and 37 (41%) were dead, injured, resuscitated, or of unknown condition (Murray 2006; NEFSC FSB on-line database). Of the 17 documented loggerhead interactions with commercial bottom otter trawl gear from March 2007 to December 2008, 14 were alive (12 were injured or uninjured and 2 required resuscitation) and 3 were fresh dead (NEFSC FSB on-line database).

6.1.3 Factors contributing to interactions between sea turtles and trawl gear

As described in Section 3.1.1, the occurrence of loggerhead sea turtles in New England and Mid-Atlantic waters north of Cape Hatteras, NC is primarily temperature dependent (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004). In general, loggerheads move up the U.S. Atlantic coast from southern wintering areas as water temperatures warm in the spring (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004). The trend is reversed in the fall as water temperatures cool. By December, loggerheads have passed Cape Hatteras, returning to more southern waters for the winter (Keinath *et al.* 1987; Shoop and Kenney 1992; Musick and Limpus 1997; Morreale and Standora 1998, 2005; Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004). Recreational anglers have reported sightings of loggerheads in waters defined as inshore waters (bays, inlets, rivers, or sounds; Braun-McNeill and Epperly 2004) as far north as New York as early as March-April, but in relatively low numbers (Braun-McNeill and Epperly 2004). Greater numbers of loggerheads are found in inshore, nearshore, and offshore waters of North Carolina and Virginia from May through November and in inshore, nearshore, and offshore waters of New York from June through October (Keinath *et al.* 1987; Morreale and Standora 1993; Braun-McNeill and Epperly 2004). Loggerheads appear to be temperature limited to water no further north than Cape Cod, Massachusetts.

Extensive survey effort of the continental shelf from Cape Hatteras, NC, to Nova Scotia, Canada, in the 1980s (CeTAP 1982) revealed that loggerheads were observed at the surface in waters from the beach to waters with bottom depths of up to 4,481 m. However, they were generally

found in waters where bottom depths ranged from 22-49 m deep (the median value was 36.6 m; Shoop and Kenney 1992). Given the seasonal occurrence patterns and water depth preferences of loggerhead sea turtles off the Mid-Atlantic and southern New England coasts, the distribution of loggerhead sea turtles is likely to overlap with the use of trawl gear for the Spring and Fall 2009 NEAMAP surveys throughout the area of operation; which includes nearshore waters from Montauk, NY to Cape Hatteras, NC as well as Block Island and Rhode Island Sounds.

Loggerhead sea turtle behaviors may influence the likelihood of them being captured in bottom trawl gear. Video footage recorded by the NMFS, Southeast Fisheries Science Center (SEFSC), Pascagoula Laboratory indicated that loggerhead sea turtles will keep swimming in front of an advancing shrimp trawl, rather than deviating to the side, until they become fatigued and are caught by the trawl or the trawl is hauled up (NMFS 2002). Loggerheads have also been observed to dive to the bottom and hunker down when alarmed by loud noise or gear (Memo to the File, L. Lankshear, December 4, 2007), which could place them in the path of bottom gear such as a bottom otter trawl. With respect to oceanographic features, a review of the data associated with the 11 sea turtles captured by the scallop dredge fishery in 2001 concluded that the sea turtles appeared to have been near the shelf/slope front (D. Mountain, pers. comm.).

Based on previous Mid-Atlantic trawl surveys by the NEFSC, invertebrate species including horseshoe crabs and blue crabs are expected to be captured during the Spring and Fall 2009 NEAMAP surveys. These as well as other crab and mollusk species are known to be prey items for loggerhead sea turtles (Lutcavage and Musick 1985; Burke *et al.* 1993; Keinath *et al.* 1987; Morreale and Standora 2005; Seney and Musick 2005). Although invertebrate bycatch is expected to be returned to the water (therefore, no expected impact on the amount of prey available to loggerheads in the area), the capture of these species at a time of year when loggerheads are known to be foraging in nearshore waters increases the likelihood that some loggerheads may be exposed to trawl gear while they are feeding on or near the bottom.

At present, the best that can be said is that interactions between loggerhead sea turtles and the trawl gear used in the Spring and Fall 2009 NEAMAP surveys are likely to occur whenever the distribution of loggerheads overlaps with the operation of trawl gear for the survey. Given the times of year the surveys will occur, the seasonal occurrence patterns of loggerheads in the action area, and the water depth preferences of these animals, loggerhead sea turtles are likely to occur wherever trawl gear for the Spring and Fall 2009 NEAMAP surveys is being towed.

6.1.4 Anticipated Incidental Take of Sea Turtles in the Spring and Fall 2009 NEAMAP Near Shore Trawl Surveys

As described in Section 2.0, the Spring and Fall 2009 NEAMAP surveys follow the same protocol as the NEFSC spring and fall bottom trawl surveys with the exception that a different (smaller draft) vessel is used and the areas surveyed are waters at depths that have been undersampled by the NEFSC bottom trawl surveys. Extensive survey effort of the continental shelf from Cape Hatteras, NC, to Nova Scotia, Canada, in the 1980s (CeTAP 1982) revealed that loggerheads were observed at the surface in waters from the beach to waters with bottom depths of up to 4,481 m. However, they were generally found in waters where bottom depths ranged

from 22-49 m deep (the median value was 36.6 m; Shoop and Kenney 1992). The bottom depth range identified for loggerheads during the CeTAP surveys encompasses the water depths previously sampled by the NEFSC bottom trawl surveys, and the water depths proposed to be sampled by the Spring and Fall 2009 NEAMAP surveys. Therefore, the likelihood of capturing a loggerhead sea turtle in gear used for the Spring and Fall 2009 NEAMAP surveys is expected to be the same as what has been reported for the NEFSC bottom trawl surveys.

Based on data compiled by the NEFSC, NMFS has previously determined the bycatch rates for loggerhead sea turtles captured in bottom otter trawl gear used in the NEFSC spring and fall bottom trawl surveys (NMFS 2007a; Tables 1 and 2). For purposes of this Opinion, NMFS is using the highest bycatch rates for each season rather than the average bycatch rate given that the proposed action is for Spring and Fall 2009 only, sea turtle captures in the NEFSC bottom otter

Table 1. Number of bottom otter trawl tows, number of loggerhead sea turtles captured, and calculated bycatch rate (no. of turtles ÷ (no. of tows x 0.5 hours per tow)) by year for the NEFSC Spring Bottom Trawl Surveys.

Year	No. of Tows	No. of Turtles Captured	Bycatch rate (turtles/tow hr)	Year	No. of Tows	No. of Turtles Captured	Bycatch rate (turtles/tow hr)
1963	N/A	N/A	N/A	1987	349	0	0
1964	N/A	N/A	N/A	1988	321	0	0
1965	N/A	N/A	N/A	1989	299	0	0
1966	N/A	N/A	N/A	1990	322	0	0
1967	N/A	N/A	N/A	1991	333	0	0
1968	265	0	0	1992	326	0	0
1969	268	0	0	1993	329	0	0
1970	342	0	0	1994	345	0	0
1971	419	0	0	1995	335	0	0
1972	366	0	0	1996	350	0	0
1973	495	0	0	1997	345	1	0.006
1974	416	0	0	1998	374	0	0
1975	303	0	0	1999	329	0	0
1976	384	0	0	2000	333	0	0
1977	354	0	0	2001	325	0	0
1978	398	0	0	2002	331	2	0.012
1979	477	0	0	2003	332	0	0
1980	468	0	0	2004	332	0	0
1981	395	1	0.005	2005	334	0	0
1982	443	2	0.009	2006	344	2	0.012
1983	428	1	0.005	2007	363	0	0
1984	407	1	0.005	2008	344	0	0
1985	391	3	0.015	Avg bycatch rate = 0.002 turtles/trawl hr			
1986	368	0	0	Highest bycatch rate = 0.015 turtles/trawl hr			

* Note: The spring bottom otter trawl surveys conducted by the NEFSC did not begin until 1968.

** In 2008, 6 loggerhead sea turtles were incidentally captured during the NEFSC spring surveys, but all of these occurred south of Cape Hatteras, outside of the action area for this consultation.

Table 2. Number of bottom otter trawl tows, number of loggerhead sea turtles captured, and calculated bycatch rate (no. of turtles ÷ (no. of tows x 0.5 hours per tow)) by year for the NEFSC Fall Bottom Trawl Surveys.

Year	No. of Tows	No. of Turtles Captured	Bycatch rate (turtles/tow hr)		Year	No. of Tows	No. of Turtles Captured	Bycatch rate (turtles/tow hr)
1963	194	0	0		1987	335	1	0.006
1964	185	0	0		1988	326	1	0.006
1965	193	0	0		1989	342	3	0.017
1966	194	0	0		1990	345	2	0.012
1967	276	0	0		1991	354	0	0
1968	279	0	0		1992	353	1	0.006
1969	282	0	0		1993	339	3	0.018
1970	312	0	0		1994	341	6	0.035
1971	334	0	0		1995	360	2	0.011
1972	646	0	0		1996	365	1	0.005
1973	451	0	0		1997	369	3	0.016
1974	379	0	0		1998	374	2	0.011
1975	406	0	0		1999	346	4	0.023
1976	340	0	0		2000	337	2	0.012
1977	419	0	0		2001	339	2	0.012
1978	556	0	0		2002	342	1	0.006
1979	600	0	0		2003	336	0	0
1980	420	0	0		2004	319	1	0.006
1981	421	1	0.005		2005	332	1	0.006
1982	449	1	0.004		2006	367	0	0
1983	476	4	0.017		2007	349	2	0.011
1984	433	0	0		2008	346	1	0.006
1985	368	1	0.005		Avg bycatch rate = 0.006 turtles/trawl hr			
1986	364	3	0.016		Highest bycatch rate = 0.035 turtles/trawl hr			

trawl surveys have been highly variable from season to season and year to year, and given that the highest bycatch rates represent levels of loggerhead captures known to have occurred in the past. As previously described, in general, the distribution of loggerheads in the areas where the surveys will be conducted is not expected to be different than the distribution of loggerheads in the areas where the NEFSC spring and fall bottom trawl surveys are conducted. While using the highest bycatch rates may overestimate the effect of the Spring and Fall 2009 NEAMAP surveys on loggerhead sea turtles, lower bycatch rates may underestimate the effects of the surveys.

Based on the highest bycatch rate observed in the NEFSC spring surveys (0.015 turtles per tow hours), and an anticipated total tow time of 50 hours for the Spring 2009 NEAMAP survey, 0.75 loggerhead sea turtles are anticipated to be captured in the bottom otter trawl gear used in the survey. Since a part of a loggerhead turtle cannot be captured, this number is rounded up to 1. Based on the highest bycatch rate observed in the NEFSC fall surveys (0.035 turtles per tow hours), and an anticipated total tow time of 50 hours for the Fall 2009 NEAMAP survey, 1.75 loggerhead sea turtles are anticipated to be captured in the bottom otter trawl gear used in the survey. Since a part of a loggerhead turtle cannot be captured, this number is rounded up to 2.

Therefore, a total of 3 loggerhead sea turtles are anticipated to be incidentally captured during the Spring and Fall 2009 NEAMAP surveys.

Tows for the Spring and Fall 2009 NEAMAP surveys will be 20 minutes in duration; a typical tow time for these surveys. Based on the analysis by Sasso and Epperly (2006) and Epperly *et al.* (2002) as well as information on captured loggerheads from NEFSC trawl surveys and the NEFSC FSB observer program, a 20-minute tow time for the bottom otter trawl gear to be used in the survey will eliminate the risk of death from forced submergence for loggerheads caught in the bottom otter trawl survey gear.

7.0 INTEGRATION AND SYNTHESIS OF EFFECTS

The *Status of Affected Species*, *Environmental Baseline*, and *Cumulative Effects* sections of this Opinion discuss the natural and human-related phenomena that caused loggerhead sea turtles to become threatened and may continue to place the species at high risk of extinction. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). The present section of this Opinion applies that definition by examining the effects of the proposed action in the context of information presented in the status of the species, environmental baseline, and cumulative effects sections to determine: (a) if the effects of the proposed action would be expected to reduce the reproduction, numbers, or distribution of loggerhead sea turtles, and (b) if any reduction in the reproduction, numbers, or distribution of loggerhead sea turtles causes an appreciable reduction in the likelihood of that species surviving and recovering in the wild.

7.1 Integration and Synthesis of Effects on Loggerhead Sea Turtles

As described above, the use of bottom otter trawl gear for the proposed activity is expected to adversely affect loggerhead sea turtles as a result of interactions with the gear resulting in capture within the gear. This Opinion has identified in Section 6.0 that the proposed activity, VIMS's Spring and Fall 2009 NEAMAP Near Shore Trawl Surveys to be funded by NMFS with pounds of summer flounder, scup, black sea bass, bluefish, and *Loligo* squid under the 2008 Mid-Atlantic RSA Program (RSA Project 09-MID-02), will directly affect loggerhead sea turtles by capturing up to three (3) individuals in the bottom otter trawl gear used for the surveys. The towing of trawl gear on benthic habitat and the temporary removal of loggerhead prey from the environment (which may be returned to the water alive or dead) as a result of the surveys will have an insignificant effect on loggerhead sea turtles. The operation of a fishing vessel on the water as a result of the survey will also have discountable effects on loggerhead sea turtles.

Loggerhead sea turtles captured in trawl gear used in the Spring and Fall 2009 NEAMAP surveys are not expected to be killed or injured. The capture of loggerhead sea turtles in comparable trawl gear used in commercial fishing operations and for the NEFSC trawl surveys has shown that the risk to sea turtles from capture in trawl gear is submergence injuries (asphyxiation or drowning as a result of forced submergence). However, tow times for trawl

gear used in the surveys will be 20 minutes or less. The tow time is part of the study protocol and is not expected to change. Based on the results of studies examining tow time and sea turtle mortality from forced submergence (Henwood and Stuntz 1987; Epperly *et al.* 2002; Sasso and Epperly 2006), a sea turtle caught in trawl gear used in the Spring and Fall 2009 NEAMAP surveys will not be killed or injured even if it is captured at the beginning of a 20-minute tow. Therefore, its capture will not have any negative effect on the sea turtle. In other words, its chances of survival and its ability to reproduce would be the same as for a loggerhead sea turtle that had not interacted with the gear. Therefore, the proposed action will not affect the numbers, reproduction, or distribution of loggerhead sea turtles in the Northwest Atlantic, and will not reduce their likelihood of survival. Since the proposed action has no effects on loggerhead sea turtles that occur elsewhere in the Atlantic or outside of the Atlantic, the proposed action will not appreciably reduce the likelihood of survival of the species.

The final revised recovery plan for loggerhead sea turtles in the Northwest Atlantic includes several objective and measurable recovery criteria which, when met, would result in a determination that the species be removed from the List of Endangered and Threatened Wildlife. Recovery criteria can be viewed as targets, or values, by which progress toward achievement of recovery objectives can be measured. Recovery criteria may include such things as population numbers and sizes, management or elimination of threats by specific mechanisms, and specific habitat conditions. As a result, there is a need to frame recovery criteria in terms of both population parameters (Demographic Recovery Criteria) and the five listing factors (Listing Factor Recovery Criteria). The nesting beach Demographic Recovery Criteria are specific to recovery units. The remaining criteria cannot be delineated by recovery unit because individuals in the recovery units mix in the marine environment; therefore, these criteria are applicable to all recovery units. Recovery criteria must be met for all recovery units (NMFS and USFWS 2008).

The Demographic Criteria for nests and nesting females were based on a time frame of one generation for U.S. loggerheads – defined as 50 years – selected as a biologically meaningful time period over which to assess recovery. To be considered for delisting, each recovery unit will have recovered to a viable level and each recovery unit will have increased for at least one generation. The rate of increase used for each recovery unit was dependent upon the level of vulnerability of each recovery unit. The minimum statistical level of detection (based on annual variability in nest counts over a generation time of 50 years) of 1% per year was used for the PFRU, the least vulnerable recovery unit. A higher rate of increase of 3% per year was used for the NGMRU and DTRU, the most vulnerable recovery units. A rate of increase of 2% per year was used for the NRU, a moderately vulnerable recovery unit (NMFS and USFWS 2008).

A fundamental problem with restricting population trend analyses to nesting beach surveys is that they are unlikely to reflect changes in the entire population. This is because of the long time lag to maturity and the relatively small proportion of females that are reproducing for the first time on a nesting beach, at least in populations with high adult survival rates. A decrease in oceanic juvenile or neritic juvenile survival rates may be masked by the natural variability in nesting female numbers and the slow response of adult abundance to changes in recruitment to the adult population (Chaloupka and Limpus 2001). In light of this, two additional Demographic Criteria were developed to ensure a more representative measure of population status was

achieved. The first of these additional Demographic Criteria assesses trends in abundance on foraging grounds, and the other assesses age-specific trends in strandings relative to age-specific trends in abundance on foraging grounds. For the foraging grounds, a network of index in-water sites, both oceanic and neritic, distributed across the foraging range must be established and monitored to measure abundance. Recovery can be achieved if there is statistical confidence (95%) that a composite estimate of relative abundance from these sites is increasing for at least one generation. For trends in strandings relative to in-water abundance, recovery can be achieved if stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation. These latter two demographic criteria are not specific to recovery units because progeny from the various recovery units mix on the foraging grounds. As a result, in-water trends were not developed for the individual recovery units (NMFS and USFWS 2008).

The Listing Factor Recovery Criteria include programs and strategies that should be implemented to respond to the following five listing factors that have caused loggerheads to be listed as a threatened species under the ESA: (1) present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) inadequacy of existing regulatory mechanisms, and (5) other natural or manmade factors affecting its continued existence. These programs involve both terrestrial and marine components (NMFS and USFWS 2008).

As described above and elsewhere in this Opinion, the Spring and Fall 2009 NEAMAP surveys are expected to adversely affect loggerhead sea turtles as a result of physical contact with and capture in the fishing gear towed during the surveys. However, no loggerhead sea turtles will be killed or injured as a result of the proposed action and no other effects to loggerhead sea turtles are expected as a result of it. The Spring and Fall 2009 NEAMAP surveys will not affect the protection of nests, nesting beaches, and the marine environment nor will they compromise the ability of researchers to conduct scientific studies or management officials to enact peer-review strategies or legislative policy. Therefore, the Spring and Fall 2009 NEAMAP surveys will have no effect on any of the Listing Factor Recovery Criteria. And, since no injury or mortality of loggerhead sea turtles is expected, the Spring and Fall 2009 NEAMAP surveys will not have any effect on the Demographic Recovery Criteria either. Therefore, the proposed action will have no effect on achieving the recovery criteria put forth in the final revised recovery plan.

In summary, the Spring and Fall 2009 NEAMAP surveys will not appreciably reduce the likelihood of loggerhead recovery because it will not affect the numbers, reproduction, or distribution of loggerhead sea turtles. Also, the surveys are not expected to modify, curtail, or destroy the range of the species since they will not reduce the numbers of loggerhead sea turtles in any of the loggerhead recovery units. The Spring and Fall 2009 NEAMAP surveys will not utilize loggerhead sea turtles for recreational, scientific, or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect loggerhead sea turtles, or affect their continued existence. The effects of the Spring and Fall 2009 NEAMAP surveys will not hasten the extinction timeline or otherwise increase the danger of extinction since the survey will not result in mortality of loggerhead sea turtles or their ability to survive and reproduce. Therefore, the Spring and Fall 2009 NEAMAP surveys will have no effect on the ESA listing factors or the

likelihood that loggerheads can be brought to the point at which they are no longer listed as endangered or threatened. In light of the conclusions of the effect of the action relative to the loggerhead recovery criteria and the ESA listing factors, the Spring and Fall 2009 NEAMAP surveys will not appreciably reduce the likelihood of recovery for the species.

8.0 CONCLUSION

After reviewing the current status of loggerhead sea turtles, the environmental baseline and cumulative effects in the action area, and the effects of the proposed action, it is NMFS's biological opinion that the proposed activity may adversely affect but is not likely to jeopardize the continued existence of loggerhead sea turtles.

9.0 INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, unless a special exemption has been granted. Take is defined as "to harass, harm, pursue, hunt, shoot, capture, or collect, or to attempt to engage in any such conduct." Incidental take is defined as take that is incidental to, and not the purpose of, the execution of an otherwise lawful activity. Under the terms of sections 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement (ITS).

When a proposed NMFS action is found to be consistent with section 7(a)(2) of the ESA, section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of incidental taking, if any. It also states that reasonable and prudent measures necessary to minimize impacts of any incidental take be provided along with implementing terms and conditions. The measures described below are non-discretionary and must therefore be undertaken in order for the exemption in section 7(o)(2) to apply. Failure to implement the terms and conditions through enforceable measures may result in a lapse of the protective coverage of section 7(o)(2).

Anticipated Amount or Extent of Incidental Take

Based on data collected from the NEFSC spring and fall trawl surveys, the similarity of gear to be used in the project and that used in the NEFSC trawl surveys, and the distribution and abundance of loggerhead sea turtles in the action area, NMFS anticipates that the NMFS funded study to be conducted by VIMS through the 2009 Mid-Atlantic RSA Program (Spring and Fall 2009 NEAMAP surveys) will result in up to three interactions (physical contact of a loggerhead sea turtle with the survey trawl gear resulting in capture, with the possibility of temporary anoxic effects from which loggerheads are expected to make a full recovery given the 20-minute tow times). None of these interactions are expected to result in death or injury. This level of incidental take is anticipated for the two 30-day survey periods in the Spring and Fall of 2009 respectively, based on the description of the proposed action.

Anticipated Impact of Incidental Take
In the accompanying Opinion, NMFS has determined that this level of anticipated take is not likely to result in jeopardy to loggerhead sea turtles. Nevertheless, NMFS must take action to minimize the impacts of these takes. The following Reasonable and Prudent Measures (RPMs) have been identified as having a reasonable likelihood of minimizing sea turtle interactions. These measures are non-discretionary and must be implemented by NMFS.

Reasonable and Prudent Measures
NMFS has determined that the following RPMs are necessary and appropriate to minimize impacts of the incidental take of sea turtles and to comply with the requirement for reporting and monitoring. RPM #1 and the accompanying Term and Condition establish the requirements for handling sea turtles captured in gear used in the Spring and Fall 2009 NEAMAP surveys in order to avoid the likelihood of injury to sea turtles that are captured in the gear from the hauling, handling, and emptying of the trawl gear. RPMs #2-#4 and the accompanying Terms and Conditions specify the collection of information for any ESA-listed species, including loggerhead sea turtles, observed captured in the gear. This information is necessary to cross check conclusions made in this Opinion and to determine the necessity for reinitiating consultation in the event the ITS is exceeded, or ESA-listed species other than loggerhead sea turtles are captured in or struck by the gear.

These RPMs have been determined to be reasonable and prudent and constitute no more than a minor change to the action since they do not require any changes to the scope, duration, or location of the proposed action. RPMs that would require a change in the timing or location of the survey in order to avoid an overlap with the distribution of loggerhead sea turtles in the area would constitute more than a minor change to the proposed action since the primary purpose of the Spring and Fall 2009 NEAMAP surveys is to collect biological information in a comparable area and at comparable times to surveys conducted by the NEFSC Spring and Fall Bottom Trawl surveys. Similarly, the 2009 NEAMAP surveys need to use a gear type that is identical to that used in the NEFSC Bottom Otter trawl surveys in order to meet the objectives of the study. Therefore, requiring a different gear type would constitute more than a minor change to the proposed action. In addition, the selected gear type is already expected to minimize the likelihood of injury to sea turtles that encounter the gear given the configuration of the gear and the relatively short tow time that will be used. Therefore, requiring a different gear type would be expected to have the same likelihood of capturing sea turtles and to also have an increased likelihood of injuring or killing any sea turtle captured. The RPMs and corresponding Terms and Conditions are:

1. Any sea turtles caught during the survey must be handled and resuscitated according to established procedures.

2. Any sea turtle caught and retrieved in trawl gear must be identified to species.

3. NMFS NERO must be notified by telephone or e-mail within 24 hours of an interaction between any endangered or threatened species, including but not limited to sea turtles, and the gear and/or vessel used in the survey.

4. NMFS NERO must receive written reports regarding endangered or threatened species interactions with trawl gear and/or vessels used in the survey.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and which outline required minimization, reporting, and monitoring requirements. These terms and conditions are non-discretionary.

1. To comply with RPM #1 above, NMFS must add the following special programmatic award condition: "VIMS must provide copies of the sea turtle handling and resuscitation requirements found at 50 CFR 223.206(d)(1) and as reproduced in Attachment A to the vessel operator prior to the commencement of any on-water activity in order for the funds to be drawn for that activity."

2. To comply with RPM #2 above, NMFS must add the following special programmatic award condition: "VIMS must ensure that there is at least one crew member who is experienced in the identification of western North Atlantic sea turtles on the vessel(s) at all times that the on-water survey work is conducted." Experience would include personnel that have received training as a NMFS fisheries observer or who have career experience in the identification of western North Atlantic sea turtles.

3. To comply with RPM #3 above, NMFS must add the following special programmatic award condition: "VIMS must notify within 24 hours the NMFS NERO staff identified below of the details of any interaction with an endangered or threatened species, including but not limited to sea turtles, during the course of the survey work. NMFS NERO staff to be contacted are: Bill Barnhill, Section 7 Biologist, at (978) 282-8460 or William.Barnhill@noaa.gov and Pat Scida, Section 7/Sea Turtle Coordinator, at (978) 281-9208 or Pasquale.Scida@noaa.gov."

4. To comply with RPMs #3 and #4 above, NMFS must add the following special programmatic award condition: "VIMS must provide a written report to NMFS NERO within 30 days of any interaction between an ESA-listed sea turtle and the gear and/or vessel used during the survey." The report must include: a clear photograph of the animal (multiple views if possible, including at least one photograph of the head scutes); identification of the animal to the species level; GPS or Loran coordinates describing the location of the interaction; time of interaction; date of interaction; condition of the animal upon retrieval (alive uninjured, alive injured, fresh dead, decomposed, comatose or unresponsive); the condition of the animal upon return to the water; GPS or Loran coordinates of the location at which it was released; and a description of the care or handling provided. This report must be sent to the NMFS Northeast Regional Office, Attn: Section 7/Sea Turtle Coordinator, 55 Great Republic Drive, Gloucester, MA 01930.

5. To comply with RPMs #3 and #4 above, NMFS must add the following special programmatic award condition: "VIMS must provide a written report to NMFS NERO within 60 days of completion of the on-water work, indicating either that no interactions with ESA-

listed species occurred, or providing the total number of interactions that occurred with ESA-listed species." This report must be sent to the NMFS Northeast Regional Office, Attn: Section 7/Sea Turtle Coordinator, 55 Great Republic Drive, Gloucester, MA 01930.

Monitoring

For purposes of monitoring the incidental take of sea turtles during the Spring and Fall 2009 NEAMAP surveys, any sea turtle: (a) found alive, dead, or injured within the trawl gear; (b) found alive, dead, or injured and retained on any portion of the trawl gear outside of the net bag; or (c) interacting with the vessel and gear in any other way must be reported to NMFS.

10.0 CONSERVATION RECOMMENDATIONS

In addition to section 7(a)(2), which requires agencies to ensure that proposed actions are not likely to jeopardize the continued existence of listed species, section 7(a)(1) of the ESA places a responsibility on all Federal agencies to utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Conservation Recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following additional measures are recommended regarding incidental take and sea turtle conservation:

1. NMFS should advise the Principal Investigator for the Spring and Fall 2009 NEAMAP surveys to provide guidance to the vessel crew members (including scientific crew and vessel operators) to the effect that: (a) all personnel are alert to the possible presence of sea turtles in the study area, (b) care must be taken when emptying the trawl gear to avoid damage to sea turtles that may be caught in the trawl but are not visible upon retrieval of the gear, and (c) the trawl is emptied as quickly as possible after retrieval in order to determine whether sea turtles are present in the gear.

11.0 REINITIATING CONSULTATION

This concludes formal consultation on the Spring and Fall 2009 NEAMAP surveys (RSA Project 09-MID-02) proposed to be funded by NMFS. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this Opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In the event that the amount or extent of incidental take is exceeded, NMFS NEFSC must immediately request reinitiation of formal consultation.

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Attachment A. Sea turtle and resuscitation measures as found at 50 CFR 223.206(d)(1).

(d) (1) (i) Any specimen taken incidentally during the course of fishing or scientific research activities must be handled with due care to prevent injury to live specimens, observed for activity, and returned to the water according to the following procedures.

(A) Sea turtles that are actively moving or determined to be dead as described in (d)(1)(i)(C) of this section must be released over the stern of the boat. In addition, they must be released only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels.

(B) Resuscitation must be attempted on sea turtles that are comatose, or inactive, as determined in paragraph (d)(1) of this section by:

(1) placing the turtle on its bottom shell (plastron) so that the turtle is right side up, and elevating its hindquarters at least 6 inches (15.2 cm) for a period of 4 up to 24 hours. The amount of the elevation depends on the size of the turtle; greater elevations are needed for larger turtles. Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches (7.6 cm) then alternate to the other side. Gently touch the eye and pinch the tail (reflex test) periodically to see if there is a response.

(2) sea turtles being resuscitated must be shaded and kept damp or moist but under no circumstance be placed into a container holding water. A water-soaked towel placed over the head, neck, and flippers is the most effective method in keeping a turtle moist.

(3) sea turtles that revive and become active must be released over the stern of the boat only when fishing or scientific collection gear is not in use, when the engine gears are in neutral position, and in areas where they are unlikely to be recaptured or injured by vessels. Sea turtles that fail to respond to the reflex test or fail to move within 4 hours (up to 24, if possible) must be returned to the water in the same manner as that for actively moving turtles.

(C) A turtle is determined to be dead if the muscles are stiff (rigor mortis) and/or the flesh has begun to rot; otherwise the turtle is determined to be comatose or inactive and resuscitation attempts are necessary.