NOAA’s National Marine Fisheries Service Endangered Species Act (ESA) - Section 7 Consultation

Biological Opinion

Agency: Marine Mammal and Sea Turtle Conservation Division of the Office of Protected Resources, NOAA’s National Marine Fisheries Service

Activity: Issuance of Endangered Species Act section 10(a)(1)(B) Incidental Take Permit # 16230 to the North Carolina Division of Marine Fisheries for the incidental take of sea turtles associated with the otherwise lawful commercial inshore gillnet fishery in North Carolina inshore state waters. [Consultation No. FPR-2013-9046]

Conducted by: Interagency Cooperation Division of the Office of Protected Resources, NOAA’s National Marine Fisheries Service

Date Issued: SEP - 6 2013

Approved by: [Signature]

Section 7(a)(2) of the Endangered Species Act (ESA) (16 U.S.C. 1531 et seq.) requires that each federal agency ensure 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” a listed species or its designated critical habitat, that action agency is required to consult with either NOAA’s National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the listed species that may be affected.

This document represents NMFS’ biological opinion (Opinion) on the issuance of an incidental take permit (ITP), and has been prepared in accordance with section 7(b) of the ESA. The ITP authorizes the take of specified levels of endangered and threatened sea turtles incidental to otherwise lawful inshore gillnet fishing in North Carolina as managed by the State of North Carolina. This Opinion is based upon our review of the State’s application and draft Conservation Plan, draft Environmental Assessment, the most current sea turtle status reviews, recovery plans, and scientific and technical reports from government agencies and peer-reviewed literature, biological opinions addressing similar forms of sea turtle take, and other sources of information, which together represent the best available scientific information on effects to sea turtle species.

A complete administrative record for this consultation is on file at the NMFS’ Office of Protected Resources (OPR).
1. Consultation History and Background Information

Consultation History
The inshore gillnet fisheries in North Carolina state waters are managed by the North Carolina Division of Marine Fisheries (NCDMF). Since 2000, NMFS has issued four separate ITPs to NCDMF for the incidental take of sea turtles in inshore gillnet fisheries occurring specifically in Pamlico Sound.

On June 21, 2000, NMFS received an application from the NCDMF for an ITP to authorize the incidental taking of listed sea turtles, incidental to the operation of the large-mesh gillnet fishery in southeastern Pamlico Sound during the fall 2000 fishing season. NMFS consulted on the issuance of the ITP for NCDMF’s application and issued an Opinion on October 5, 2000. We determined that issuance of the ITP and the operation of the southern flounder gillnet fishery, under NCDMF management, was not expected to jeopardize the continued existence of loggerhead, green, and Kemp’s ridley populations in the wild. We approved the ITP on October 5 and NCDMF validated it by signing on October 24. The ITP expired December 16, 2000.

On August 8, 2001, NCDMF submitted a second application, including a conservation plan, for an ITP for the shallow water (generally < 3 ft) gillnet fishery in southeastern Pamlico Sound to be effective from September 15 through December 15, 2001. NMFS consulted on the issuance of the ITP for NCDMF’s application and issued an Opinion on September 26, 2001. We determined that issuance of the ITP and the operation of the southern flounder gillnet fishery, under NCDMF management, was not likely to jeopardize the continued existence of loggerhead, green, and Kemp’s ridley populations in the wild. We approved the ITP on September 28, 2001, and it expired December 16, 2001.

On July 18, 2002, NCDMF submitted an application, including a conservation plan, for a third ITP for the shallow water gillnet fishery in southeastern Pamlico Sound and the mainland along the shoreline of Hyde and Pamlico Counties. The management measures were to be effective from September 1 through December 15 each year for 2002 through 2004. We determined that issuance of the ITP and the operation of the southern flounder gillnet fishery, under NCDMF management, was not likely to jeopardize the continued existence of loggerhead, green, and Kemp’s ridley populations in the wild. We approved the ITP on September 28, 2001, and it expired December 16, 2004.

On April 1, 2005 NCDMF applied for a fourth ITP for the shallow water gillnet fishery in southeastern Pamlico Sound. The application included a conservation plan, as required. As with the previous ITPs, we determined that issuance of the ITP and the operation of the fishery was not likely to jeopardize the continued existence of any sea turtle species in the wild. On August 18, 2005, NMFS issued ITP 1528 to NCDMF for a 6-year period from 2005-2010.
On June 14, 2010, the NCDMF submitted a new ITP application with an expanded scope, to address sea turtle interactions with set gillnets throughout North Carolina internal coastal waters. The expanded scope was based in part on a February 23, 2010, lawsuit filed by the Duke Environmental Law and Policy Clinic against NCDMF on behalf of the Karen Beasley Sea Turtle Rescue and Rehabilitation Center (Beasley Center) for the illegal taking of sea turtles in state regulated inshore gillnet fisheries which resulted in a Settlement Agreement (described in detail in the Background Information section below). Based on comments from NMFS, a revised ITP application was submitted on August 17, 2011. On October 5, 2011 NMFS published a Notice of Receipt of the State’s draft application for a Section 10(a)(1)(B) ITP for its commercial inshore gillnet fishery and made available the application and conservation plan for public review and comment for 30 days (76 FR 61670, October 5, 2011). Upon reviewing the public comments, NMFS requested that NCDMF make several modifications to the application.

On August 24, 2012, NMFS signed an authorization letter extending the coverage of Pamlico Sound ITP 1528 through the end of the 2012 fishing season while the application for the statewide inshore gillnet ITP that would include Pamlico Sound was being processed.

On September 6, 2012 (updated January 18 and June 13, 2013), NCDMF submitted an amended application to NMFS for an ITP to incidentally take ESA-listed sea turtles associated with large and small mesh gillnet fisheries operating in all inshore state waters year round. The ITP application includes the existing provisions of the Settlement Agreement and resulting proclamations, as well as additional management measures as part of a state-wide conservation plan. On October 31, 2012, NMFS published a second Notice of Receipt of NCDMF’s application and a request for public comment in the Federal Register (77 FR 65864, October 31, 2012). The 30-day public comment period ended on November 30, 2012.

Background Information
North Carolina’s inshore estuarine system is created by a chain of barrier islands that run along nearly the entire coast. These waters are described as the internal coastal waters of North Carolina. Inlets within these barrier islands allow saline ocean water to mix with fresh water which is provided by a network of river systems to the west. This estuary provides prime habitat for numerous finfish species that are harvested by residents and visitors to North Carolina in both the commercial and recreational fisheries. Commercial and recreational fishermen deploy gillnets in North Carolina’s estuarine and ocean waters. Gillnet fishing in North Carolina is regulated by NCDMF through proclamations issued by the Director of NCDMF. Existing NCDMF proclamation requirements include mandatory attendance of gillnets in some areas and gear, yardage limits, soak-time restrictions, net shot limits, tie down requirements, closed areas, mesh size restrictions, minimum distance between fishing operations, marking requirements, reporting requirement, and monitoring requirements. Gillnet fisheries and related restrictions differ throughout the state depending on the season, target species, location, and physical
characteristics of water body being fished. In general, there are three primary set
techniques: anchored set nets, floating drift nets, and strike or runaround nets. Anchored
gillnets are the primary concern for sea turtle interactions in North Carolina.

Large mesh (≥4-inch stretched mesh (ISM)) fisheries primarily target five fish species -
southern flounder (*Paralichthys lethostigma*), striped bass (*Morone saxatilis*), American
shad (*Alosa sapidissima*), hickory shad (*Alosa mediocris*), and catfishes (*Ictalurus sp*). The most common mesh size for all large mesh gillnet fisheries is 5 ½ ISM. Small mesh (<4 ISM) gillnet operations target a more diverse array of species relative to large mesh
gillnet fisheries. Mesh sizes generally fall between 3 and 3 ¾ ISM. Small mesh gillnet
fisheries primarily target spot (*Leiostomus xanthurus*), striped mullet (*Mugil cephalus*),
bluefish (*Pomatomus saltatrix*), spotted seatrout (*Cynoscion nebulosus*), weakfish
(*Cynoscion regalis*), Atlantic menhaden (*Brevoortia tyrannus*), Spanish mackerel
(*Scomberomorus maculatus*), white perch (*Morone americana*), and kingfishes
(*Menticirrhus sp*).

During the fall of 1999, increased sea turtle strandings were noted by the North Carolina
Sea Turtle Stranding and Salvage Network (NC STSSN) in the southeastern portion of
Pamlico Sound. As a result, initial monitoring of the gillnet fisheries in 1999 identified
the large mesh gillnet fishery as the probable source of sea turtle interactions in Pamlico
Sound during the fall months. With this information, NMFS issued an emergency 30-day
rule closing Pamlico Sound to large mesh gillnet fishing (≥5 ISM) for the end of the 1999
fall season (64 FR 70196, December 16, 1999).

In the fall of 2000, NMFS issued Incidental Take Permit (ITP) 1259 to NCDMF to
manage the deep and shallow water gillnet fishery in Pamlico Sound, establishing the
Pamlico Sound Gillnet Restricted Area (PSGNRA). The goal of the Habitat
Conservation Plan (conservation plan) for ITP 1259 was for NCDMF to monitor sea
turtle interactions in the fall gillnet fishery in the PSGNRA and to implement
management measures to reduce sea turtle mortality by 50% between September 15 and
December 15, 2000, as compared to the levels of take seen in the strandings of 1999. The
ITP also set corresponding limits on the allowed levels of observed takes of sea turtles,
both lethal and non-lethal takes, and documented strandings.

NCDMF closed the fishery to gillnets ≥5 ISM on October 27, 2000 when sea turtle takes
exceeded the levels authorized in ITP 1259. However, from October 28 to December 15,
2000, 59 sea turtles stranded within the PSGNRA. It was determined that some fisherman
re-equipped their nets with 4-7/8 ISM, to circumvent the closure and continue fishing,
primarily targeting flounder. Fisherman using small-mesh gear to target sea trout or
mackerel were unaffected by the closure and continued to fish within the PSGNRA. Due
to demonstrated capture and mortality of sea turtles in large-mesh gillnets before the
closure, NMFS believed that the continued, unmonitored gillnet fishing in and around the
PSGNRA after the closure contributed to most of the subsequent sea turtle strandings.

In the fall of 2001, NMFS issued ITP 1348 to NCDMF which authorized the incidental
taking of sea turtles in the fall gillnet fisheries in Pamlico Sound and mandated further
restrictions for the 2001 fishing season. The conservation plan for ITP 1348 included the creation of three specified Shallow-water Gillnet Restricted Areas (SGNRAs) around the inside of the Outer Banks in Pamlico Sound and two inlet corridors at Hatteras and Ocracoke Inlets. Large and small mesh gillnet fishing operations in the SGNRAs were required to have a special permit from NCDMF, were required to accept observers, and were required to file weekly reports of fishing catch and effort to NCDMF. On August 22, 2001, NCDMF issued a state fisheries proclamation that implemented these management measures, effective September 15, 2001. NMFS published an interim final rule (66 FR 50350, October 3, 2001) restricting fishing with gillnets greater than 4 ¼ ISM in Pamlico Sound from September 28 through December 15, 2001. NCDMF permit holders were exempted from the closure if they complied with the ITP conditions required in the NCDMF proclamation.

The ITP 1348 application and conservation plan only addressed the gillnet fisheries that occur in the SGNRAs and inlet areas. They did not include a requested take authorization or management measures for the large-mesh, deep-water component of the gillnet fishery in Pamlico Sound. This component of the fishery used more net per vessel, soaked the nets longer and had higher sea turtle catch and mortality rates in 2000 than the shallow-water components. This deep-water component of the fishery remained closed for the 2001 season.

NMFS then published a final rule the following year on September 6, 2002 (67 FR 56931, September 6, 2002) closing all waters of Pamlico Sound to fishing with gillnets greater than 4 ¼ ISM from September 1 through December 15 each year. The closed area included all inshore waters of Pamlico Sound, and remains in place.

In the summer of 2002, NMFS issued ITP 1398 to NCDMF which authorized the incidental take of sea turtles in shallow-water, large mesh gillnets in Pamlico Sound for a period of 3 years, including the fall seasons of 2002, 2003 and 2004. ITP 1398 expanded the management area to include waters within 200 yards of the mainland shore of Pamlico and Hyde Counties. The associated conservation plan required intensive sea turtle monitoring and a fishery characterization program throughout the PSGNRA annually from September through December.

In 2005, NMFS issued ITP 1528 to NCDMF which authorized the incidental take of sea turtles in shallow-water, large mesh gillnets in Pamlico Sound for a period of 6 years, including the fall seasons between 2005 and 2010. The conservation plan for ITP 1528 included management measures, restricted and prohibited areas, and monitoring requirements similar to past management actions, as well as several changes from past ITPs. The changes made to the PSGNRA in 2005 included: establishment of a state closure in addition to the federal closure to provide state jurisdiction and enforcement authority, modification of observer program procedures to better direct resources to times and areas of higher potential for sea turtle interactions, and elimination of the requirements along the mainland side of Pamlico Sound due to the small number of interactions in this area NCDMF has monitored the shallow water gillnet fishery in Pamlico Sound since 2001. From 2002-2004 there were 25 observed turtle interactions.
throughout the PSGNRA in large mesh gillnets. Of the 25 observed turtle interactions, green turtles were the most common species observed (n=17), followed by loggerheads (n=5) and Kemp’s ridleys (n=3). The majority of the interactions (72%) were live individuals that were subsequently tagged and released at or near inlets in good condition. During this period no sea turtle interactions were observed in small mesh gillnet gear.

From 2005-2011 there were 103 observed turtle interactions throughout the PSGNRA in large mesh gillnets. Of the 103 observed turtle interactions, green turtles were the most common species observed (n=83), followed by Kemp’s ridleys (n=10), then loggerheads (n=9) and hawksbill turtles (n=1). The majority of interactions (69%) were live individuals that were subsequently tagged and released.

In addition to the PSGNRA observed takes, 16 sea turtle interactions were observed outside of the PSGNRA from 2007-2011 in large mesh gillnet operations in North Carolina estuarine waters. The interactions were comprised of green turtles (n = 5), loggerhead turtles (n = 2), and Kemp’s ridley turtles (n = 8), and one unidentified hard-shelled turtle.

NMFS operated an Alternative Platform (AP) observer program in Core Sound, North Carolina from June through November 2009. Through this program, NMFS observers’ documented 22 sea turtle takes in large mesh gillnets. Similar to NCDMF observer effort, green turtles were the most common species observed (n = 12), followed by Kemp’s ridley (n = 5) and loggerhead (n = 5). The majority of interactions (73%) involved live individuals that were subsequently tagged and released (NMFS unpublished data). As a result of this effort, NMFS notified NCDMF of its concern for these unauthorized takes in Core Sound and potentially other North Carolina inshore waters.

NCDMF began operating an AP observer program in 2010 for both large and small mesh gillnets. In 2010-2011, across all seasons, 55 sea turtle interactions were observed by the AP program. Of these interactions Kemp’s ridleys were the most common (n = 29), followed by green turtles (n = 22) and loggerhead turtles (n = 4).

In 2012, 26 sea turtle interactions were observed by NCDMF in the state-wide large mesh gillnet fishery. Green turtles were the most common species observed (n = 19), followed by Kemp’s ridley (n = 4), loggerhead (n = 1) and unidentified hard-shell species (n = 2). The majority of interactions (n = 22) involved live individuals that were subsequently tagged and released.

On February 23, 2010, the Duke Environmental Law and Policy Clinic filed suit against NCDMF and the North Carolina Marine Fisheries Commission (NCMFC) on behalf of the Karen Beasley Sea Turtle Rescue and Rehabilitation Center (Beasley Center) for the illegal taking of sea turtles in state regulated inshore gillnet fisheries. Negotiations between the parties occurred in the spring of 2010 resulting in a final Settlement Agreement between the Beasley Center and NCDMF and the NCMFC. As a result of the Settlement Agreement, NCDMF issued proclamation M-8-2010 effective May 15, 2010, implementing the provisions discussed in the Settlement Agreement. Gillnet restrictions
implemented by the proclamation included: a stretch mesh size range of 4 ISM to, and including, 6 ½ ISM for large mesh gillnets; soak times limited to overnight soaks an hour before sunset to an hour after sunrise, Monday evenings through Friday mornings; large mesh gillnets were restricted to a height of no more than 15 meshes, constructed with a lead core or leaded bottom line and without corks or floats other than needed for identification; a maximum of 2,000 yards of large mesh gillnets allowed to be used per vessel; and maximum individual net (shot) length of 100 yards with a 25-yard break between shots. Fishermen in the southern portion of the state were allowed to use floats on nets but were restricted to the use of a maximum of 1,000 yards of large mesh gillnet per fishing operation.

Section 5(a) of the Settlement Agreement specifies: “The restrictions as listed in Paragraph 1, 2(e) and 2(i) are minimum requirements for the 2010 statewide ITP application.” Paragraph 1 specifies the restrictions on large mesh gillnet, Section 2(e) pertains to different restrictions in the southern portion of the state as described above, and Section 2(i) specifies that the restrictions apply to standard commercial fishing license holders and recreational commercial gear license holders.

Section 5(d) of the Settlement Agreement states “The restrictions as listed in Paragraphs 1, 2(e) and 2(i) are deemed solely interim measures and will be in effect within internal coastal waters, not otherwise exempt, until NMFS issues NCDMF an ITP for the affected areas.” The Settlement Agreement also states that the Agreement shall not foreclose more lenient or more restrictive provisions in future ITPs if warranted by biological data collected through reliable sources including, but not limited to, NMFS and NCDMF.

As described above, the NCDMF submitted an application for an ITP to address sea turtle interactions with set gillnets in North Carolina internal coastal waters on June 14, 2010, with revisions submitted in August 2011 based on comments provided by NMFS. Following the public comment period NMFS requested additional modifications to the application.

While the statewide ITP was being processed, the Pamlico Sound Gillnet Restricted Area ITP had expired, and the fishing season for Pamlico Sound was approaching. NCDMF intended to include all inshore gillnet fishing into the statewide ITP. On August 24, 2012, NMFS signed an authorization letter extending the coverage of the expired Pamlico Sound ITP #1528 through the end of the 2012 fishing season while the application for the statewide inshore gillnet ITP that would include Pamlico Sound was being processed.

On September 6, 2012 (updated January 18 and June 13, 2013), NCDMF submitted an amended application to NMFS for an ITP to incidentally take ESA-listed sea turtles associated with large and small mesh gillnet fisheries operating in all inshore state waters year round. The ITP application includes the existing provisions of the Settlement Agreement and resulting proclamations, as well as additional management measures as part of a state-wide conservation plan. The application and conservation plan includes take requests for endangered Kemp’s ridley, leatherback, and hawksbill sea turtles and threatened green and loggerhead sea turtles. On October 31, 2012, NMFS published a
second Notice of Receipt of NCDMF’s application and a request for public comment in the Federal Register (77 FR 65864, October 31, 2012). The 30-day public comment period ended on November 30, 2012. Subsequent updates to the application were submitted on January 18 and June 13, 2013, in response to requests for revisions and clarifications in the modeling, take estimates, the monitoring program, and inclusion of an Implementing Agreement by NMFS.

2. Description of the Proposed Action

The proposed ESA Section 10(a)(1)(B) ITP would authorize the incidental take of green, hawksbill, Kemp’s ridley, leatherback and loggerhead sea turtles during the otherwise lawful operation of the commercial inshore gillnet fishery managed by NCDMF. As requested in the application, the ITP would be valid for ten years and would require NCDMF to operate the inshore gillnet fishery as described below in the proposed conservation plan. This alternative would include issuing the take levels proposed in the September 6, 2012 (updated January 18 and June 13, 2013) application and conservation plan.

In addition to sea turtles, NMFS anticipates that the proposed action may affect Atlantic sturgeon; however NCDMF has submitted a separate application for a section 10(a)(1)(B) ITP to specifically address impacts to Atlantic sturgeon from this fishery, which will have its own associated Biological Opinion. Impacts to Atlantic sturgeon from the inshore gillnet fishery are not covered under this Opinion; thus, incidental take of Atlantic sturgeon by this fishery will remain illegal until the ITP and Biological Opinion for that species are finalized.

2.1 Description of the Fishery

North Carolina allows commercial and recreational gillnet fishing in both inshore and ocean waters. This Opinion is for the requested section 10 ITP for the inshore gillnet fisheries and thus the description will be limited to those fisheries. The North Carolina inshore estuarine system is created by a chain of barrier islands along nearly the entire coast and is defined as the internal coastal waters of North Carolina. Inlets within these barrier islands allow saline ocean water to mix with fresh water which is provided by a network of river systems to the west (Figure 2.1). This estuary provides prime habitat for numerous finfish species that are harvested by residents and visitors to North Carolina in both the recreational and commercial fisheries, including gillnet fisheries. NCDMF manages the inshore gillnet fisheries and has provided the characterization of the gears used, areas and seasonality of the fisheries, target species information, dockside values, participation levels, and other information below.
Regulation of inshore gillnets occurs through fisheries rules adopted by the North Carolina Marine Fisheries Commission (NCMFC) and proclamations issued by the director of NCDMF. Such regulations include mandatory attendance, yardage limits, soak-time restrictions, net shot limits, tie down requirements, closed areas (primary nursery areas, Pamlico Sound Gillnet Restricted Area - PSGNRA), mesh size restrictions, minimum distance between fishing operations, marking requirements, permit mandates (PSGNRA), and observer requirements (PSGNRA, Core Sound 2009, Beasley Settlement Agreement).

Gillnet fisheries and related restrictions differ throughout the state depending on season, target species, location, and physical characteristics of water body being fished. In general, there are three primary set techniques: anchored set nets, floating drift nets, and strike or runaround nets. Anchored gillnets are passive sets deployed with an anchor or stake at one or both ends of the net shots or operation.
Typically, these nets fish from the bottom upward into the water column. Drift nets are floated with the tides, are not anchored, and are typically used in deeper water areas such as near ocean inlets. With strike or runaround gillnet fisheries, the gear is set and quickly retrieved after surrounding a school of fish.

Anchored gillnets are the primary concern for sea turtle interactions. The drift and runaround gillnet fisheries are executed quickly enough that sea turtle interactions, if any, are minimal. Fishermen typically survey an area before gear is deployed and therefore can determine if sea turtles are present before gear deployment. This Opinion primarily deals with the anchored gillnet fisheries as that is the focus of the ITP.

Gillnets may be used to target specific size ranges of fish due to the selectivity of different mesh sizes. Consequently, fishermen use gillnets of different mesh sizes to target different species. Commonly used mesh sizes in NC estuarine waters range from 2 ½ inch stretch mesh (ISM) to 6 ½ ISM. Mesh size limitations are frequently established by fisheries rules or by NCDMF proclamation(s).

In addition to the monitoring efforts throughout the fall PSGNRA from 2001 through 2011, commercial estuarine gillnet observer coverage has been expanded throughout the state since 2004. Information gathered during observer trips includes data on effort and mesh sizes used, as well as data on the size and disposition of captured species (NCDMF 2008; Price 2007a, 2009a, 2010b; Boyd 2012). The NCDMF uses data from its trip ticket program and fish house samples in addition to observations of commercial trips to characterize North Carolina’s estuarine gillnet fishery. Many commercially valuable species are targeted by gillnets throughout the year with fishermen utilizing specific mesh size nets depending on the target species.

Large mesh (≥4-inch stretched mesh (ISM)) fisheries primarily target five fish species - southern flounder *Paralichthys lethostigma*, striped bass *Morone saxatilis*, American shad *Alosa sapidissima*, hickory shad *Alosa mediocris*, and catfishes *Ictalurus sp.* Large mesh gillnet fisheries for southern flounder traditionally operate throughout the majority of the sounds and lower estuarine river systems with a peak in effort in the fall months (September through November). Estuarine fisheries for striped bass, which are managed in most areas as bycatch fisheries by the NCDMF, are more limited in time and space due to the anadromous migration pattern of this species. Striped bass gillnet fisheries are permitted subject to regulation from late October through late April with a closed season from May through September. The majority of striped bass harvest occurs in the Albemarle Sound with additional early spring effort occurring in the Pamlico Sound and the Pamlico and Neuse river systems. Shad fishing operations occur almost exclusively from January 1 through April 14 due to their anadromous migration patterns and distribution. Catfish are harvested with large mesh gillnets in the rivers and western Albemarle Sound with the majority of catches occurring during the winter to spring months. The most common mesh size for all large mesh gillnet fisheries is 5½ ISM.

Small mesh (<4 ISM) gillnet operations target a more diverse array of species than large mesh gillnet fisheries. Mesh sizes used in small mesh gillnet operations vary more than
those used in large mesh fisheries. However, the most commonly used small mesh sizes generally fall between 3 and 3¼ ISM. Small mesh gillnet fisheries primarily target spot *Leiostomus xanthurus*, striped mullet *Mugil cephalus*, bluefish *Pomatomus saltatrix*, spotted seatrout *Cynoscion nebulosus*, weakfish *Cynoscion regalis*, Atlantic menhaden *Brevoortia tyrannus*, Spanish mackerel *Scomberomorus maculatus*, white perch *Morone americana*, and kingfishes *Menticirrhus sp*. Peaks in spot landings occur in the spring and summer (April through June) and fall (October through November) months and are landed throughout the estuarine waters and river systems. Striped mullet are landed year round, but peaks occur in the fall (October through November). Bluefish are also landed year round throughout the estuarine and river systems with most landings occurring in the spring during April and May. Spotted seatrout and weakfish are targeted by small mesh gillnet operations primarily in the fall and winter months (September through January). Weakfish landings may also peak in the spring during April and May. Atlantic menhaden are mostly targeted during the spring (February through May) with another peak in landings occurring in October. Spanish mackerel are primarily targeted during the spring, summer, and fall months. White perch are almost exclusively targeted during the winter and spring months (December through April). Kingfishes are targeted primarily in the spring and the fall.

**Landings and Values**
The number of annual estuarine gillnet trips averaged 39,000 from 1994 through 2011. Estuarine gillnet trips declined from a high of 51,000 in 1997 to 25,000 trips in 2011. Estuarine gillnets were responsible for landings valued at 5.1 million dollars in 2011 and averaged 6.1 million dollars per year in value from 1994 to 2011. The top ten valued species in 2011 from NC estuarine gillnets were southern flounder, striped mullet, Spanish mackerel, striped bass, spot, bluefish, white perch, American shad, red drum, and kingfishes. These species made up 92% of the total ex-vessel value for estuarine gillnets in NC for 2011. Gillnet landings are responsible for 50% of the total NC estuarine landings for all of the top ten species in 2011. In addition, for six of the top ten species landed from gillnets in estuarine waters in 2011, gillnets were responsible for more than 80% of the total NC estuarine landings for each species. Large mesh (≥5 ISM) gillnet fisheries (e.g., southern flounder, red drum, striped bass, American shad) account for 48% of the total estuarine gillnet value and 55% of the total estuarine gillnet number of trips for 2011.

**Sea Turtle Interaction Trends**
Since 2006, observed and estimated sea turtle interactions in commercial large mesh gillnet fisheries in the PSGNRA have increased (Price 2010a; Boyd 2011). Interactions have also been observed outside of the PSGNRA through commercial gillnet observations by the NCDMF and the 2009 NMFS alternative platform (AP) observer work in Core Sound (Price 2007b, 2009b; Boyd 2012; NMFS unpublished data). From 1999 through 2011, a total of 226 sea turtles have been observed by NCDMF in the estuarine gillnet fisheries throughout North Carolina. Of the 226 sea turtles observed, measurements have been recorded (n = 207) for the majority (92%) of them. Green sea turtles (n = 139; 62%) ranged from 115 mm to 457 mm (curved carapace length [CCL] from notch to tip). Kemp’s ridley sea turtles (n = 61; 27%) ranged from 110 mm to 559
Loggerhead sea turtles (n = 23; 10%) ranged from 300 mm to 1,067 mm CCL. There have only been two hawksbill sea turtle interactions (250 mm and 330 mm CCL) during the eleven-year period and one unidentified sea turtle with no measurement.

From 2005 to 2011, 103 sea turtle interactions were observed in the PSGNRA. Of these, 80% were green sea turtles, 8.7% were loggerhead sea turtles, and 9.7% were Kemp's ridley sea turtles. Also, one hawksbill sea turtle interaction was observed in the PSGNRA in 2009 (Price 2010a). The majority (69%) of observed sea turtle interactions in the PSGNRA were live individuals that were subsequently tagged and released.

A total of eleven sea turtle interactions were observed outside of the PSGNRA from January 2004 through December 2009 in large mesh gillnet operations in NC estuarine waters. The interactions were comprised of green turtles (n = 6; 3 alive, 3 dead), loggerhead turtles (n =1; alive), and Kemp's ridley turtles (n = 4; 2 alive, 2 dead).

In the summer and fall of 2009, the NMFS AP observations in Core Sound indicated similar sea turtle mortality trends (NMFS unpublished data). The majority (55%) of observed interactions involved green sea turtles (n = 12) with Kemp’s ridley (23%; n = 5) and loggerhead (23%; n =5) also being observed. Of the total interactions for all species combined (n = 22), 73% involved live individuals.

In 2010, NCDMF began a dedicated statewide observer program to characterize sea turtle interactions throughout the estuarine gillnet fisheries in North Carolina. From 2010 through 2011, a total of 85 observed sea turtle observations occurred. Interactions (n = 85) occurred throughout North Carolina estuarine waters with all but one occurring in Management Units B, C, D1, D2, and E. One interaction occurred on the border of Management Unit A and B in the Roanoke Sound. The mortality rate was 18% for all observed interactions from 2010 through 2011.

2.2 Conservation Plan

The purpose of the proposed ITP will be to protect and conserve sea turtles frequenting North Carolina inshore waters. This will be accomplished by implementing management measures for all gillnet fishing operations in those waters. The conservation plan prepared by NCDMF describes measures designed to monitor, minimize, and mitigate the incidental take of ESA-listed sea turtles. The conservation plan includes managing inshore gillnet fisheries by dividing estuarine waters into 6 management units (i.e., A, B, C, D1, D2, E). Each of the management units would be monitored seasonally. The proposed management units are defined as follows:

**Management Unit A** encompasses all estuarine waters north of 35° 46.30’N to the North Carolina/Virginia state line. This includes all of Albemarle, Currituck, Croatan, and Roanoke Sounds as well as the contributing river systems in this area. Most of this area is currently defined as the Albemarle Sound Management Area (ASMA).
Management Unit B encompasses all estuarine waters south of 35° 46.30’N, east of 76° 30.00’W, and north of 34° 48.27’N. This Management Unit includes all of Pamlico Sound and the Northern portion of Core Sound.

1. Shallow Water Gillnet Restricted Area (SGNRA) 1 is the area from Wainwright Island to Ocracoke Inlet bound by the following points: Beginning at a point on Core Banks at 34° 58.7963’N - 76° 10.0013’W, running northwesterly to Marker # 2CS at the mouth of Wainwright Channel at 35° 00.2780’N - 76° 12.1682’W, then running northeasterly to Marker “HL” at 35° 01.5665’N - 76° 11.4277’W, then running northeasterly to Marker #1 at 35° 09.7058’N - 76° 04.7528’W, then running southeasterly to a point at Beacon Island at 35° 05.9352’N - 76° 02.7408’W, then running south to a point on the northeast corner of Portsmouth Island at 35° 03.7014’N - 76° 02.2595’W, then running southwesterly along the shore of Core Banks to the point of beginning.

2. SGNRA 2 is the area from Ocracoke Inlet to Hatteras Inlet bound by the following points: Beginning at a point near Marker #7 at the mouth of Silver Lake at 35° 06.9091’N - 75° 59.3882’W, running north to Marker # 11 near Big Foot Slough Entrance at 35° 08.7890’N - 76° 00.3606’W, then running northeasterly to a point at 35° 13.4489’N’N - 75° 47.5531’W, then running south to a point northwest of the Ocracoke/Hatteras Ferry terminal on the Ocracoke side at 35° 11.5985’N - 75° 47.0768’W, then southwesterly along the shore to a point of beginning.

3. SGNRA 3 is the area from Hatteras to Avon Channel bound by the following points: The area from Hatteras to Avon Channel bound by the following points: Beginning at a point near Marker “HR” at 35° 13.3152’N – 75° 41.6694’W, running northwest near Marker “42 RC” at Hatteras Channel at 35° 16.7617’N – 75° 44.2341’W, then running easterly to a point off Marker #2 at Cape Channel at 35° 19.0380’N – 75° 36.2993’W, then running northeasterly near Marker #1 at the Avon Channel Entrance at 35° 22.8212’N – 75° 33.5984’W, then running southeasterly near Marker #6 on Avon Channel at 35° 20.8224’N - 75° 31.5708’W, then running easterly near Marker #8 at 35° 20.9412’N – 75° 30.9058’W, then running to a point on shore at 35° 20.9562’N - 75° 30.8472’W, then following the shoreline in a southerly and westerly direction to the point of beginning.

4. SGNRA 4 is the area from Avon Channel to Rodanthe bound by the following points: Beginning at a point near Marker #1 at the Avon Channel Entrance at 35° 22.8212’N - 75° 33.5984’W, then running northerly to a Point on Gull Island at 35° 28.4495’N - 75° 31.3247’W, then running north near Marker “ICC” at 35° 35.9891’N – 75° 31.2419’W, then running northwesterly to a point at 35° 41.0000’N – 75° 33.8397’N – 75° 29.3271’W, then following the shoreline in a southerly direction to a point on shore near Avon Harbor at 35° 20.9562’N - 75° 30.8472’W, then running westerly near Marker #8 at 35° 20.9412’N - 75°
30°.9058’W, then running westerly near Marker #6 on Avon Channel at 35° 20.8224’N - 75° 31.5708’W, then running northwesterly to the point of beginning.

5. Ocracoke Corridor (OC) is the area in Ocracoke Inlet bound by the following points: Beginning at a point at 35° 07.9390’N - 76° 03.8080’W, then running northeasterly to Marker #9 at Nine Foot Shoal Entrance at 35° 08.4411’N - 76° 02.6848’W, then running northeasterly to Marker "14 BF" at 35° 09.3627’N - 76° 00.6259’W, then running southeast to Marker #7 at the mouth of Silver Lake at 35° 06.9091’N - 75° 59.3882’W, then following the shoreline southwesterly to a point at the north side of Ocracoke Inlet at 35° 04.4200’N - 75° 59.9245’W, then crossing the inlet to a point on Portsmouth Island at 35° 03.7014’N - 76° 02.2595’W, then in a northerly direction to a point on Beacon Island at 35° 05.9352N - 76° 02.7408’W, then running in a northwesterly direction to the point of beginning.

6. Hatteras Corridor (HC) is the area in Hatteras Inlet bound by the following points: Beginning at a point at 35° 13.4489’N - 75° 47.5531’W, running east to the site of an old platform at 35° 14.0100’N - 75° 45.8097’W, then running northeast to Marker "42 RC" at the mouth of Hatteras Channel at 35° 16.7617’N - 75° 44.2341’W, then following the channel to Marker "HR" at 35° 13.3152’N - 75° 41.6694’W, then following the shoreline to a point on the north side of Hatteras Inlet at 35° 11.3408’N - 75° 44.9907’W, then crossing the inlet to the south side to a point on Ocracoke Island at 35° 11.0793’N - 75° 45.9645’W, then following the shoreline northwest to a point northwest of the Ocracoke/Hatteras ferry terminal at 35° 11.5985’N - 75° 47.0768’W, then running in a northerly direction to the point of beginning.

7. Oregon Inlet Corridor (OIC) is the area in Oregon Inlet bound by the following points: Beginning at a point at Marker #12 at Old House Channel at 35° 45.0883’N - 75° 35.9600’W, then following the channel in a northeasterly direction to Marker #53 at 35° 47.2157’N - 75° 34.4264’W, then running easterly to Marker #13 near Oregon Inlet Fishing Center harbor entrance at 35° 47.7076’N - 75° 32.9762’W, then running southerly to a point on the south side of Oregon Inlet at 35° 46.0500’N- 75° 31.6166’W, then running in a southerly direction along the shoreline to a point at 35° 41.0000’N - 75_ 29.3271’W, then running west to a point at 35° 41.0000’N - 75° 33.8397’W, then in a northerly direction to the point of beginning.

8. Mainland Gillnet Restricted Area (MGNRA) is the area on the mainland side of Pamlico Sound, from the shoreline of Hyde and Pamlico Counties out to 200 yards between 76° 30’W and 75° 42’W.

Management Unit C includes the Pamlico, Pungo, and Neuse river drainages west of 76° 30.00’W.
Management Unit D1 encompasses all estuarine waters south of 34° 48.27’N and east of a line running from 34° 40.70’N – 76° 22.50’W to 34° 42.48’N – 76° 36.70’W. Management Unit D-1 includes Southern Core Sound, Back Sound, and North River.

Management Unit D2 encompasses all estuarine waters west of a line running from 34° 40.70’N – 76° 22.50’W to 34° 42.48’N – 76° 36.70’W to the Highway 58 bridge. Management Unit D-2 includes Newport River and Bogue Sound.

Management Unit E encompasses all estuarine waters south and west of the Highway 58 bridge to the North Carolina/South Carolina state line. This includes the Atlantic Intracoastal Waterway (ICW) and adjacent sounds and the New, Cape Fear, Lockwood Folly, White Oak, and Shallotte rivers.

Summary of Conservation Plan
Each of the management units detailed above would be monitored seasonally and by fishery. Management units were delineated on the basis of three primary factors: similarity of fisheries and management, extent of known protected species interactions in commercial gillnet fisheries, and unit size and the ability of NCDMF to monitor fishing effort.

Management measures identified in the proposed conservation plan include:

1. Restricted soak times for large mesh gillnets from one hour before sunset on Monday through Thursday and one hour after sunrise from Tuesday through Friday (i.e., fishing is prohibited from one hour after sunrise on Friday through one hour before sunset on Monday);
2. Restrictions on the maximum net length per large mesh fishing operation (i.e., 2,000 yards (1.83 km, 6,000 ft.) per operation except south of the North Carolina Highway 58 bridge and Management Area D2 where 1,000 yards (0.91 km, 3,000 ft.) is maximum;
3. Restrictions on large mesh net-shot lengths to 100 yards (91.44 m, 300 ft.) with a 25 yard (22.86 m, 75 ft.) separation between each net-shot;
4. Requirement for large mesh nets to be low profile (e.g., maximum of 15 meshes in depth, tie-downs prohibited, floats or corks prohibited along float lines north of the North Carolina Highway 58 bridge);
5. Closure of Management Area D1 to unattended large mesh gillnets from May 8 – October 14 annually;
6. Prohibition on large mesh gillnets in the deep water portions of the PSGNRA and Oregon, Hatteras, and Ocracoke inlets from September 1 – December 15; and
7. Adaptive fishery management measures and restrictions through state proclamation authority (e.g., gear and/or area restrictions, attendance requirements, increased observer coverage and/or enforcement).
Continuation of North Carolina’s regulations for small mesh gillnet attendance requirements.

Adaptive Management and Mitigation Measures
NCDMF will also use a variety of adaptive fishery management measures and restrictions through their state proclamation authority to reduce sea turtle mortality and prohibit fishing in management units where incidental take thresholds are approaching authorized take levels. NCDMF will use proclamation authority to implement management measures necessary to reduce sea turtle takes in estuarine gillnet fisheries in North Carolina. Proclamation authority allows NCDMF to implement timely responses (i.e., within 48 hours) that may provide increased protection of sea turtles, for example appropriate restrictions may include gear or area restrictions, attendance requirements, modifications in observer coverage, increased enforcement, or a combination of these and other restrictions. The need for additional management measures or better direction of resources will be determined by NCDMF in consultation with NMFS.

Potential adaptive management restrictions may include gear or area restrictions, attendance requirements, modifications in observer coverage, increased enforcement, or a combination of these and other restrictions. The NCDMF will consult regularly with the NMFS SERO and the NMFS OPR to ensure that monitoring and management programs maintain the flexibility for the NCDMF to monitor, anticipate, respond, and implement needed action. A long-term adaptive approach will provide for the protection and conservation of sea turtles and other protected species.

Another key component of an adaptive monitoring program is the identification of areas of high potential for bycatch of protected species in gillnet fisheries through observed interactions and on the water sightings of sea turtles by the NCDMF observers, biological staff, the NC STSSN, Marine Patrol, reports from commercial and recreational fishermen, and the general public. These areas will be referred to as hotspots and will provide managers the opportunity to address bycatch concerns through timely implementation of conservation measures such as increased observer and Marine Patrol coverage, additional gear restrictions, and temporary and/or seasonal closures. A hotspot will be defined as any area where sea turtle observations and/or sightings are above the previous two-year average for the season and Management Unit and has the potential for increased interactions. Hotspot areas will be identified and handled proactively and reactively. For any given Management Unit during a season that shows high sea turtle abundance, NCDMF may close the Management Unit for the duration of the defined season.

In addition to the adaptive management activities described above, NCDMF must ensure (i.e. issue a proclamation) that all commercial and recreational fishermen report all incidental captures of sea turtle to NCDMF and require that fisherman follow the requirements listed below for the safe handling, resuscitation and disposition of any incidentally captured turtles. Human safety is paramount and will supersede these requirements as necessary.
Sea Turtle Handling and Resuscitation Requirements:

a) Fishermen must bring captured turtles aboard immediately upon detecting them in their net and remove them from the net with all due care to avoid further injury to the turtle.

b) Resuscitation must be attempted on sea turtles that are inactive or comatose by placing the turtle in its normal position on its breastplate (plastron) and elevating its hindquarters several inches 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. Sea turtles being resuscitated must be kept moist and protected from excessive heat and cold.

c) Sea turtles that are actively moving or begin actively moving following resuscitation must be held aboard the vessel in an open container (e.g. a fish box) that allows the turtle to rest normally on its breastplate, while restricting its movement and preventing the possibility of injury from any fishing operations. Turtles that are too large to fit inside a holding container must be otherwise confined to an area of the vessel that is free of sharp objects or harmful materials and where chance of injury from fishing operations is minimal.

d) For all comatose or revived turtles, the NC STSSN must be contacted immediately so the animal can be transferred to rehabilitation for evaluation.

Incidentally Taken Sea Turtle Specimens:

a) Release of active and uninjured sea turtles: Live uninjured turtles should be released immediately following capture. The release location should be far enough from the nets to avoid immediate recapture, but within the vicinity of where they were captured. Turtles must be released over the stern or side of the boat with the engine out of gear, in an area where they are unlikely to be recaptured by other nets or injured by vessels.

b) For sea turtles that are injured, lethargic, or dead, fishermen must immediately contact the NCDMF Marine Patrol and transfer the turtle to an NCDMF patrol vessel. If no NCDMF patrol vessel is in the vicinity, fishermen must transport the turtle immediately to the nearest U.S. Coast Guard Station and contact the NC STSSN immediately to arrange for transfer of the turtle to a rehabilitation facility.

Tagging of Incidentally Taken Sea Turtle Specimens:

Observers must tag all live, active turtles prior to release with two flipper tags and one passive integrated transponder (PIT) tag. Tagging procedures must be coordinated with and tag data must be submitted to the Cooperative Marine Turtle Tagging Program of the University of Florida. NCDMF must coordinate with NMFS on observer training programs. NMFS will provide, based on available staff, training for observers on handling and tagging sea turtles.

Stranding Monitoring:

Independent from this ITP, the NC STSSN, operated by the North Carolina Wildlife Resources Commission (NCWRC), monitors the strandings of sea turtles in inshore areas. NCDMF must provide copies of all take reports to the NC STSSN within 24 hours.
Monitoring
NCDMF will maintain a monitoring program that consists of a combination of onboard and alternative platform observers, trip ticket program, and marine patrol officer activities (when needed). NCDMF will monitor six primary management units in inshore waters as described in the conservation plan. NCDMF will monitor at least 7% (with a goal of 10%) of large mesh (≥4.0 ISM) gillnet trips in each area during each of 3 seasons (i.e., spring, summer, fall) as defined in the conservation plan. Turtles are most likely to occur in NC waters during spring, summer, and fall seasons; therefore, the monitoring plan seeks to ensure that adequate observer coverage is provided for those three seasons. However, as sea turtle distribution is influenced by water temperature (Braun-McNeill et al. 2008), during mild winters sea turtles may still be present in North Carolina inshore waters for at least a portion of the season. As such, while a specific level of monitoring is not required in the winter, if a turtle is observed or reported by a fisherman, NCDMF must collect the take data and report the take to NMFS and the NC STSSN within 24 hours.

NCDMF will monitor at least 1% (with a goal of 2%) of small mesh (<4.0 ISM) gillnet trips in each area during each of 3 seasons (i.e., spring, summer, fall) as defined in the conservation plan. Small mesh observer coverage will be maintained at a lower level than large mesh gillnet coverage due to existing small mesh gillnet attendance requirements, which requires fishermen to stay onsite with their nets while fishing, is in place to minimize undersized red drum bycatch. The attendance requirements apply to approximately 95% of the small mesh gillnets in operation between May and November each year, and therefore occur in areas and times where sea turtles are most commonly found. It is expected that a lower level of observer coverage will be necessary, as fishermen are required to tend their nets and report any interactions to NCDMF.

NCDMF will utilize data collected through the Observer Program using the methodologies outlined in the conservation plan to conduct annual analysis to better understand bycatch estimates for Kemp’s ridley and green turtles. Weekly and monthly estimated sea turtle takes will be calculated by NCDMF to ensure authorized estimated and/or observed take levels are not being approached. After the first three years, NCDMF will utilize data collected through the Observer Program using the methodologies outlined in the conservation plan to conduct an analysis to determine whether bycatch may be estimated for loggerhead turtles in each area. Observer data collected prior to the issuance of the ITP will also be used to create a more robust data set. If it is possible to conduct this analysis, NCDMF will provide those estimates to NMFS and discuss whether adaptive management is necessary.

NCDMF will monitor data collected and identify, in a timely manner, whether unusually high sea turtle bycatch occurred within a management unit or subunit, such that NCDMF determines that closure and evaluation is necessary to (1) avoid approaching a take limit, or (2) provide adequate protection for sea turtles, or (3) to allow sea turtles to complete a
seasonal migration and minimize interactions. NCDMF will confer with the NMFS on the identification of hotspots.

**Reporting**
NCDMF will provide progress reports and annual reports to NMFS on a regular basis to monitor implementation of the original conservation plan and ITP and determine whether adaptive management is necessary.

**Take Reports:** NCDMF will report all incidental sea turtle takes to NMFS via email within 24 hours of their occurrence in any season of the year (spring, summer, fall and winter), whether documented by an observer or reported by a fisherman. Reports of incidental take should include the date of the take, the condition of the turtle, the species (if known), photographs, and any other pertinent details of the circumstances of the taking (e.g., location, gear description, etc.). NCDMF will also provide copies of all take reports to the NC STSSN within 24 hours of the take.

**Weekly Progress Reports:** For those weeks in which sea turtle interactions are documented, a weekly report must be submitted to the NMFS OPR by Friday of the following week. The weekly reports must include the weekly take estimates and cumulative totals, including: observed takes with species, location, condition, and photos; and the total number of observed trips in that area.

**Seasonal Progress Reports:** Progress reports must be submitted to the NMFS OPR within 30 days after the end of the spring, summer, and fall seasons (i.e., June 30, September 30, and December 31). The reports must include:

a) A summary of the weekly reporting information previously submitted;

b) Descriptions of any additional management measures taken by NCDMF;

c) One or more maps or graphical displays illustrating the geographic distribution of all observed large and small mesh gillnet trips and the locations of all observed incidental takes of sea turtles;

d) The number of law enforcement contacts made with gillnet vessels the nature of these contacts;

e) Any violations detected by NCDMF of the proclamations implementing the requirements of this ITP, and the status of all resulting enforcement actions; and

f) A description of any adaptive management actions taken.

**Annual Reports:** NCDMF will prepare annual written reports for each year during which the Plan is in effect. A year is defined as beginning September 1 and ending the following August 31 (e.g., September 1, 2013 through August 31, 2014). NCDMF will submit annual reports for September 1 through August 31 to NMFS by the following January 31 (i.e., 5 months after the year ends). A summary of the key contents of each annual report is provided below:
a) Actual and estimated incidental takes (including mortality) and the level of uncertainty of the estimates (e.g., confidence intervals) of Covered Species by management units as described in the conservation plan;
b) Size composition, disposition (alive/dead), location, and dates of incidental take of Covered Species recorded during monitoring program as described in the conservation plan and conservation plan Appendix;
c) One or more maps or graphical representations illustrating the geographic distribution of all observed large and small mesh gillnet hauls and the locations of all observed incidental sea turtle takes; and
d) A description of the mitigation activities, adaptive management actions, and enforcement activities conducted.

Additionally, within 2 years of ITP implementation, NCDMF will obtain certifications from each fisherman intending to use anchored gillnets in inshore waters as defined in the conservation plan that the fisherman acknowledges the ITP requirements and wishes to be included under that ITP. NCDMF will periodically compare trip ticket data to the certifications to ensure that any new entrants into the fishery are certified. NCDMF will annually remind certified fishermen of the ITP requirements. Alternatively, NCDMF will implement a permit or license system, whereby the permit or license would serve as a certificate of inclusion, for fishermen using anchored gillnets in inshore waters to ensure compliance with the conservation plan, ITP, and this Agreement.

2.3 Action Area

The action area for this consultation consists of the inshore estuarine waters of North Carolina as delineated by the management areas defined above in Section 2.2. Direct effects of incidental capture will occur within the action area. However, the species affected by the ITP are highly migratory, and the effects would encompass the populations as they migrate throughout the western north Atlantic.

2.4 Annual Anticipated Incidental Take

The anticipated levels of annual incidental take are specified in the tables below. The amount of incidental take is expressed as either estimated or observed depending on the amount of data available for modeling the predicted takes. A more detailed explanation of the modeling procedure and available data used in the model is available in the ITP application from NCDMF. For green and Kemp’s ridley sea turtle takes in large mesh gillnet gear, sufficient historical take data is available to appropriately model the total annual estimated number of interactions that are likely to occur in Management Units B, D1, D2, and E. Throughout the ITP duration NCDMF will calculate total annual estimated take levels for green and Kemp’s ridley sea turtles in each Management Unit by using a model that will extrapolate the observed takes that are documented (Table 2.1).

For loggerhead, leatherback and hawksbill sea turtles, sufficient data does not currently exist to allow for the appropriate modeling exercise to extrapolate the number of annual
estimated takes in large mesh gillnet gear. As such, the anticipated take for these species in large mesh gillnet gear cannot be determined. The incidental take statement for this Opinion for these species will be based on the actual number of annual observed takes to be allowed per the ITP without a calculation for estimated total take (Table 2.2). Similarly, sufficient data does not currently exist to allow for the appropriate modeling exercise to extrapolate the number overall estimated takes in small mesh gillnet gear for any sea turtle species in Management Units B, D1, D2 and E, nor for any takes that might occur in Management Units A and C. As such, the anticipated take cannot be calculated and the incidental take statement for this Opinion will only contain total observed takes without a calculation to determine estimated takes for small mesh gillnets and for all takes occurring in Management Units A and C (Tables 2.3 and 2.4). It is important to note that in the Effects of the Action section later in this document consideration will be given to the fact that the observed-only take levels represent only an unknown subset of the actual take, as no annual estimated take level could be calculated. Although annual estimates are unable to be calculated, NCDMF will closely monitor the observed take, as well as other data sources on sea turtle presence, to ensure proper adaptive management is used.

Estimated and Observed Takes
A generalized linear model (GLM) framework was used to estimate sea turtle interactions in North Carolina’s estuarine gillnet fisheries based on data collected from 2007 through 2011. Estimated numbers of interactions will be calculated based on observed interactions using the same best-fitting GLM for each species and assuming effort levels equivalent to those observed in 2010. Through this model, NCDMF will be able to estimate take based on mesh size, year, season, and Management Unit. Mesh sizes are categorized as large ($\geq$4 ISM) or small (<4 ISM). Seasons are designated as: winter (December–February); spring (March–May); summer (June–August); and fall (September–November). Management Units are defined elsewhere in the ITP (A, B, C, D1, D2, and E, as described above). Estimates will be calculated weekly as well as monthly and will be provided to the NMFS OPR.

Estimated takes were calculated using a GLM model for the following areas and species.
- Kemp’s ridley sea turtles in large mesh gillnet gear in Management Units B, D1, D2, and E (Table 2.1).
- Green sea turtles in large mesh gillnet gear in Management Units B, D1 and E (Table 2.1).

Observed takes were calculated for areas and/or species where insufficient data exists to model an annual take estimate. This applies to the following species, areas and gear.
- Green sea turtles in large mesh gillnet gear in Management Unit D2 (Table 2.2).
- Loggerhead, leatherback and hawksbill sea turtles in large mesh gillnet gear in Management Units B, D1, D2, and E (Table 2.2).
- All species in small mesh gillnet gear in Management Units B, D1, D2, and E (Table 2.3).
- All species, both large and small mesh gillnet gear, in Management Units A and C (Table 2.4).
Table 2.1 Anticipated annual *estimated* takes in large mesh (≥4 inch stretched mesh) gillnets.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Estimated Take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>D1</td>
</tr>
<tr>
<td></td>
<td>Estimated</td>
<td>Estimated</td>
</tr>
<tr>
<td></td>
<td>live</td>
<td>dead</td>
</tr>
<tr>
<td>Green</td>
<td>225</td>
<td>112</td>
</tr>
<tr>
<td>Kemp’s ridley</td>
<td>53</td>
<td>26</td>
</tr>
<tr>
<td><strong>Total Estimated Take</strong></td>
<td><strong>278</strong></td>
<td><strong>138</strong></td>
</tr>
</tbody>
</table>

Table 2.2 Anticipated annual *observed* (not estimated) takes in large mesh (≥4 inch stretched mesh) gillnets.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Observed Take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>D1</td>
</tr>
<tr>
<td></td>
<td>Observed (live/dead)</td>
<td>Observed (live/dead)</td>
</tr>
<tr>
<td>Green</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hawksbill</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Leatherback</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Observed Take</strong></td>
<td><strong>5</strong></td>
<td><strong>5</strong></td>
</tr>
</tbody>
</table>

Table 2.3 Anticipated annual *observed* (not estimated) takes in small mesh (<4 inch stretched mesh) gillnets.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Observed Take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>D1</td>
</tr>
<tr>
<td></td>
<td>Observed (live/dead)</td>
<td>Observed (live/dead)</td>
</tr>
<tr>
<td>Green</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Hawksbill</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kemp’s ridley</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Leatherback</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Observed Take</strong></td>
<td><strong>11</strong></td>
<td><strong>11</strong></td>
</tr>
</tbody>
</table>
Table 2.4 Anticipated annual observed (not estimated) takes in large mesh (≥4 inch stretched mesh) and small mesh (<4 inch stretched mesh) gillnets combined.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Observed Take</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green, Hawksbill, Kemp’s ridley, Leatherback, Loggerhead</td>
<td>4 turtles of any species</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 2.5 Total annual anticipated take (estimated and observed) by species and condition.

<table>
<thead>
<tr>
<th>Total Annual Takes</th>
<th>Observed live/dead</th>
<th>Estimated live</th>
<th>Estimated dead</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>18</td>
<td>330</td>
<td>165</td>
</tr>
<tr>
<td>Hawksbill</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Kemp’s ridley</td>
<td>12</td>
<td>98</td>
<td>49</td>
</tr>
<tr>
<td>Leatherback</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>24</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Any Species</td>
<td>8</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Annual Take</td>
<td>78</td>
<td>428</td>
<td>214</td>
</tr>
</tbody>
</table>

3. Status of Listed Species and Critical Habitat

Listed species occurring within the action area that may be affected by the proposed action include five species of sea turtles and Atlantic sturgeon. Table 3.1 lists each species, scientific name and status, as well as the specific geographic area within the action area in which each species occurs. Critical habitat for loggerhead sea turtles has also been proposed, including some in-water habitat in North Carolina (78 FR 43005; July 18, 2013).
Table 3.1. Status of Listed Species in the Action Area (E= Endangered, T=Threatened)

<table>
<thead>
<tr>
<th>Species</th>
<th>Scientific Name</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Turtles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loggerhead sea turtle</td>
<td>Caretta caretta</td>
<td>T</td>
</tr>
<tr>
<td>Atlantic (NWA) DPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green sea turtle</td>
<td>Chelonia mydas</td>
<td>E/T1</td>
</tr>
<tr>
<td>Leatherback sea turtle</td>
<td>Dermochelys coriacea</td>
<td>E</td>
</tr>
<tr>
<td>Hawksbill sea turtle</td>
<td>Eretmochelys imbricata</td>
<td>E</td>
</tr>
<tr>
<td>Kemp’s ridley sea turtle</td>
<td>Lepidochelys kempii</td>
<td>E</td>
</tr>
<tr>
<td>Sturgeon</td>
<td>Atlantic sturgeon</td>
<td>E</td>
</tr>
</tbody>
</table>

3.1 Analysis of Species and Critical Habitats Not Likely to be Adversely Affected

The proposed in-water critical habitat for loggerhead sea turtles does not extend into the inshore waters of North Carolina. Therefore, critical habitat for loggerhead sea turtles will not be considered further in this Opinion.

3.2 Analysis of Species Likely to be Adversely Affected

Green, hawksbill, Kemp’s ridley, leatherback, and loggerhead sea turtles, and Atlantic sturgeon, are all likely to be adversely affected by the proposed action. Concurrent to the application process for ITP #16320, NMFS has also received a separate ITP application requesting incidental take of Atlantic sturgeon in the same inshore gillnet fisheries. As such, this EA and associated ITP documents do not specifically consider the impacts to Atlantic sturgeon, as this species will be considered fully in the separate ITP process and corresponding ESA consultation. Therefore, any take of sturgeon by in the North Carolina inshore gillnet fishery will not have ESA section 7 incidental take coverage until the sturgeon-specific ITP and associated biological opinion is finalized. The remaining sections of this Opinion will focus only on the sea turtle species.

The following subsections are synopses of the best available information on the status of the species that are likely to be adversely affected by one or more components of the proposed action, including information on the distribution, population structure, life history, abundance, and population trends of each species and threats to each species. The biology and ecology of these species as well as their status and trends inform the effects analysis for this opinion. Additional background information on the status of sea turtle species can be found in a number of published documents, including: recovery plans for the Atlantic green sea turtle (NMFS and USFWS 1991), hawksbill sea turtle (NMFS and USFWS 1993), Kemp’s ridley sea turtle (NMFS and USFWS 1992b; NMFS, USFWS, and SEMARNAT 2011), leatherback sea turtle (NMFS and USFWS 1992a), and loggerhead sea turtle (NMFS and USFWS 2008a); Pacific sea turtle recovery plans (NMFS and USFWS 1998a, NMFS and USFWS 1998b, NMFS and USFWS 1998c, NMFS and USFWS 1998d); and sea turtle 5-year and status reviews, stock assessments, and biological reports (Conant et al. 2009, NMFS-SEFSC 2001, NMFS-SEFSC 2009,

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1 Green sea turtles in U.S. waters are listed as threatened except for the Florida breeding population, which is listed as endangered.
3.2.1 General Threats Faced by All Sea Turtle Species

Sea turtles face numerous natural and anthropogenic threats that shape their status and affect their ability to recover. As many of the threats are either the same or similar in nature for all listed sea turtle species, those identified in this section below are discussed in a general sense for all listed sea turtles. Threat information specific to a particular species are then discussed in the corresponding status sections where appropriate.

Fisheries
Incidental bycatch in commercial fisheries is identified as a major contributor to past declines, and threat to future recovery, for all of the sea turtle species (NMFS and USFWS 1991, 1992, 1993, 2008, 2011).

Domestic fisheries often capture, injure, and kill sea turtles at various life stages. Sea turtles in the pelagic environment are exposed to U.S. Atlantic pelagic longline fisheries. Sea turtles in the benthic environment in waters off the coastal United States are exposed to a suite of other fisheries in federal and state waters. These fishing methods include trawls, gillnets, purse seines, hook-and-line gear [including bottom longlines and vertical lines (e.g., bandit gear, handlines, and rod-reel)], pound nets, and trap fisheries. Refer to the Environmental Baseline section of this opinion for more specific information regarding federal and state managed fisheries affecting sea turtles within the action area. The Southeast U.S. shrimp fisheries have historically been the largest fishery threat to benthic sea turtles in the southeastern United States, and continue to interact with and kill large numbers of sea turtles each year.

In addition to domestic fisheries, sea turtles are subject to direct as well as incidental capture in numerous foreign fisheries, further impeding the ability of sea turtles to survive and recover on a global scale. For example, pelagic stage sea turtles, especially loggerheads and leatherbacks, circumnavigating the Atlantic are susceptible to international longline fisheries including the Azorean, Spanish, and various other fleets (Aguilar et al. 1995; Bolten et al. 1994; Crouse 1999). Bottom longlines and gillnet fishing is known to occur in many foreign waters, including (but not limited to) the northwest Atlantic, western Mediterranean, South America, West Africa, Central America, and the Caribbean. Shrimp trawl fisheries are also occurring off the shores of numerous foreign countries and pose a significant threat to sea turtles similar to the impacts seen in U.S. waters. Many unreported takes or incomplete records by foreign fleets make it difficult to characterize the total impact that international fishing pressure is having on listed sea turtles. Nevertheless, international fisheries represent a continuing threat to sea turtle survival and recovery throughout their respective ranges.

Non-Fishery In-Water Activities
There are also many non-fishery impacts affecting the status of sea turtle species, both in the ocean and on land. In nearshore waters of the United States, the construction and maintenance of federal navigation channels has been identified as a source of sea turtle mortality. Hopper dredges, which are frequently used in ocean bar channels and sometimes in harbor channels and offshore borrow areas, move relatively rapidly and can entrain and kill sea turtles (NMFS 1997). Sea turtles entering coastal or inshore areas have also been affected by entrainment in the cooling-water systems of electrical generating plants. Other nearshore threats include harassment and/or injury resulting from private and commercial vessel operations, military detonations and training exercises, in-water construction activities, and scientific research activities.

**Coastal Development and Erosion Control**
Coastal development can deter or interfere with nesting, affect nesting success, and degrade nesting habitats for sea turtles. Structural impacts to nesting habitat include the construction of buildings and pilings, beach armoring and nourishment, and sand extraction (Bouchard et al. 1998; Lutcavage et al. 1997). These factors may decrease the amount of nesting area available to females and change the natural behaviors of both adults and hatchlings, directly or indirectly, through loss of beach habitat or changing thermal profiles and increasing erosion, respectively. (Ackerman 1997; Witherington et al. 2003; Witherington et al. 2007). In addition, coastal development is usually accompanied by artificial lighting which can alter the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings that are drawn away from the water (Witherington and Bjorndal 1991). In-water erosion control structures such as breakwaters, groins, and jetties can impact nesting females and hatchling as they approach and leave the surf zone or head out to sea by creating physical blockage, concentrating predators, creating longshore currents, and disrupting of wave patterns.

**Environmental Contamination**
Multiple municipal, industrial, and household sources, as well as atmospheric transport, introduce various pollutants such as pesticides, hydrocarbons, organochlorides (e.g., DDT, PCBs, and PFCs), and others that may cause adverse health effects to sea turtles (Garrett 2004; Grant and Ross 2002; Hartwell 2004; Iwata et al. 1993). Acute exposure to hydrocarbons from petroleum products released into the environment via oil spills and other discharges may directly injure individuals through skin contact with oils (Geraci 1990), inhalation at the water’s surface and ingesting compounds while feeding (Matkin and Saulitis 1997). Hydrocarbons also have the potential to impact prey populations, and therefore may affect listed species indirectly by reducing food availability in the action area. In 2010, there was a massive oil spill in the Gulf of Mexico at BP’s Deepwater Horizon (DWH) well. Official estimates are that millions of barrels of oil were released into the Gulf of Mexico. Additionally, approximately 1.8 million gallons of chemical dispersant was applied on the seawater surface and at the wellhead to attempt to break down the oil. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.
Marine debris is a continuing problem for sea turtles. Sea turtles living in the pelagic environment commonly eat or become entangled in marine debris (e.g., tar balls, plastic bags/pellets, balloons, and ghost fishing gear) as they feed along oceanographic fronts where debris and their natural food items converge. This is especially problematic for sea turtles that spend all or significant portions of their life cycle in the pelagic environment (i.e., leatherbacks, juvenile loggerheads, and juvenile green turtles).

**Climate Change**

There is a large and growing body of literature on past, present, and future impacts of global climate change, exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA’s climate information portal provides basic background information on these and other measured or anticipated effects (see [http://www.climate.gov](http://www.climate.gov)).

Climate change impacts on sea turtles currently cannot be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of sea turtles may result (NMFS and USFWS 2007c). In sea turtles, sex is determined by the ambient sand temperature (during the middle third of incubation) with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007c).

The effects from increased temperatures may be intensified on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). These impacts will be exacerbated by sea level rise. If females nest on the seaward side of the erosion control structures, nests may be exposed to repeated tidal overwash (NMFS and USFWS 2007c). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Baker et al. 2006; Daniels et al. 1993; Fish et al. 2005). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., ocean acidification, salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of lower trophic levels (e.g., phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc.) which could ultimately affect the primary foraging areas of sea turtles.

**Other Threats**

Predation by various land predators is a threat to developing nests and emerging hatchlings. The major natural predators of sea turtle nests are mammals, including
raccoons, dogs, pigs, skunks, and badgers. Emergent hatchlings are preyed upon by these mammals as well as ghost crabs, laughing gulls, and the exotic South American fire ant (*Solenopsis invicta*). In addition to natural predation, direct harvest of eggs and adults from beaches in foreign countries continues to be a problem for various sea turtle species throughout their ranges (NMFS and USFWS 2008a).

Diseases, toxic blooms from algae and other microorganisms, and cold stunning events are additional sources of mortality that can range from local and limited to wide-scale and impacting hundreds or thousands of animals.

**Actions Taken to Reduce Threats**

Actions have been taken to reduce man-made impacts to sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatching survival, as well as measures to reduce the mortality of pelagic immatures, benthic immatures, and sexually mature age classes from various fisheries and other marine activities. Some actions have resulted in significant steps towards reducing the recurring sources of mortality of sea turtles in the environmental baseline and improving the status of all sea turtle populations in the Atlantic and Gulf of Mexico. For example, the Turtle Excluder Device (TED) regulation published on February 21, 2003 (68 FR 8456), represents a significant improvement in the baseline effects of trawl fisheries on sea turtles, though shrimp trawling is still considered to be one of the largest source of anthropogenic mortality for most of our sea turtle species (NMFS-SEFSC 2009).

**3.2.2 Loggerhead Sea Turtle – NW Atlantic DPS**

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. NMFS and USFWS published a final rule designating nine DPSs for loggerhead sea turtles (76 FR 58868, September 22, 2011; effective October 24, 2011). The DPSs established by this rule are: (1) Northwest Atlantic Ocean (threatened); (2) Northeast Atlantic Ocean (endangered); (3) South Atlantic Ocean (threatened); (4) Mediterranean Sea (endangered); (5) North Pacific Ocean (endangered); (6) South Pacific Ocean (endangered); (7) North Indian Ocean (endangered); (8) Southeast Indo-Pacific Ocean (endangered); and (9) Southwest Indian Ocean (threatened). The Northwest Atlantic (NWA) DPS is the only one that regularly occurs within the action area and therefore is the only one to be considered in this opinion.

On March 25, 2013 USFWS published a proposed critical habitat designation for the Northwest Atlantic Ocean Loggerhead Sea Turtle DPS (78 FR 17999), and on July 18, 2013 NMFS published a proposed critical habitat designation for the same DPS (78 FR 43005). Specific areas proposed for designation include 36 occupied marine areas within the range of the Northwest Atlantic Ocean DPS. These areas contain one or a combination of nearshore reproductive habitat, winter area, breeding areas, and migratory corridors. The proposed critical habitat does not specifically overlap with the proposed action area.
Species Description and Distribution

Loggerheads are large sea turtles with a mean straight carapace length (SCL) of adults in the southeast United States of approximately 3 ft (92 cm). The corresponding mass is approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, 5 pairs of costals, 5 vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd 1988).

The loggerhead sea turtle inhabits oceanic and continental shelf waters (including estuarine waters) throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd 1988). Oceanic juveniles are associated with convergence zones and feed primarily at or near the surface. Neritic juveniles primarily feed benthically on mollusks but will also prey on other taxa including crabs and jellyfish. Adult loggerheads are primarily found on the continental shelf and primarily prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

The majority of loggerhead nesting occurs at the western rims of the Atlantic and Indian Oceans concentrated in the north and south temperate zones and subtropics (NRC 1990). In the western North Atlantic, loggerhead nesting is concentrated along the coasts of the United States from southern North Carolina to the southwest Florida coast. Additional nesting beaches are found along the northern and western Gulf of Mexico, eastern Yucatán Peninsula, at Cay Sal Bank in the eastern Bahamas (Addison 1997; Addison and Morford 1996), off the southwestern coast of Cuba (Gavilan 2001), and along the coasts of Central America, Colombia, Venezuela, and the eastern Caribbean Islands.

Within the NW Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. Previous Section 7 analyses have recognized at least five Western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to Northeast Florida at about 29°N; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast of the state to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the Eastern Yucatán Peninsula, Mexico (Márquez M 1990; TEGW 2000a); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS-SEFSC 2001). The Recovery Plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: (1) the Northern Recovery
(Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008a). Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

Life History Information
The Northwest Atlantic Loggerhead Recovery Team defined the following eight life stages for the loggerhead life cycle, including the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long lived organisms that reach sexual maturity between 20 and 38 years of age, although this varies widely among populations (Frazer and Ehrhart 1985; NMFS and SEFSC 2001). Female loggerheads deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984) but an individual female only nests every 3.7 years on average (Tucker 2010). Along the southeastern U.S. coast, loggerheads lay an average of 100 and 126 eggs per nest (Dodd 1988) which incubate for 42 to 75 days before hatching (NMFS and USFWS 2008b).

As post-hatchlings, loggerheads hatched on U.S. beaches migrate offshore and become associated with Sargassum habitats, drift lines, and other convergence zones (Carr 1986), (Witherington 2002). Loggerheads originating from the NWA DPS are believed to lead a pelagic existence in the North Atlantic Gyre for a period as long as 7-12 years (Bolten et al. 1998) before moving to more coastal habitats. Recent studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Bolten and Witherington 2003; Laurent et al. 1998). These studies suggest some turtles may either remain in the pelagic habitat in the North Atlantic longer than hypothesized or move back and forth between pelagic and coastal habitats interchangeably (Witzell 2002). Stranding records indicate that when immature loggerheads reach 15-24 inches (40-60 cm) SCL, they recruit to coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Estuarine waters of the United States, including areas such as Long Island Sound, Chesapeake Bay, Pamlico and Core Sounds, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, and numerous

\[\text{neritic refers to the inshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters}\]
embayments fringing the Gulf of Mexico, comprise important inshore habitat. Along the
Atlantic and Gulf of Mexico shoreline, essentially all shelf waters are inhabited by
loggerheads.

Like juveniles, non-nesting adult loggerheads also use the neritic zone. Adult
loggerheads tend to use estuarine areas with more open ocean access, such as Chesapeake
Bay in the U.S. mid-Atlantic. Shallow-water habitats with large expanses of open ocean
access, such as Florida Bay, provide year-round resident foraging areas for significant
numbers of male and female adult loggerheads. Offshore, adults primarily inhabit
continental shelf waters, from New York south through Florida, The Bahamas, Cuba, and
the Gulf of Mexico. Seasonal use of mid-Atlantic shelf waters, especially offshore New
Jersey, Delaware, and Virginia during summer months, and offshore shelf waters, such as
Onslow Bay (off the North Carolina coast), during winter months has also been
documented (Hawkes et al. 2007a; Georgia Department of Natural Resources,
unpublished data; South Carolina Department of Natural Resources, unpublished data).
Satellite telemetry has identified the shelf waters along the west Florida coast, The
Bahamas, Cuba, and the Yucatán Peninsula as important resident areas for adult female
loggerheads that nest in Florida (Foley et al. 2008; M. Lamont, Florida Cooperative Fish
and Wildlife Research Unit, personal communication, 2009; M. Nicholas, National Park
Service, personal communication, 2009). The southern edge of the Grand Bahama Bank
is important habitat for loggerheads nesting on the Cay Sal Bank in The Bahamas, but
nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged
Islands as well as Florida Bay in the United States, and the north coast of Cuba (A.
report the recapture in Cuban waters of five adult female loggerheads originally tagged in
Quintana Roo, Mexico, indicating that Cuban shelf waters likely also provide foraging
habitat for adult females that nest in Mexico.

Status and Population Dynamics
A number of stock assessments and similar reviews (Conant et al. 2009; Heppell et al.
2003a; NMFS-SEFSC 2009; NMFS and SEFSC 2001; NMFS and USFWS 2008a;
TEWG 1998; TEWG 2000a; TEWG 2009) have examined the stock status of
loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate
of absolute population size.

Numbers of nests and nesting females can vary widely from year to year. However,
nesting beach surveys can provide a reliable assessment of trends in the adult female
population, due to the strong nest site fidelity of female loggerhead sea turtles, as long as
such studies are sufficiently long and effort and methods are standardized [see, e.g.,
NMFS and USFWS (2008a)]. NMFS and USFWS (2008a) concluded that the lack of
change in two important demographic parameters of loggerheads, remigration interval
and clutch frequency, indicate that time series on numbers of nests can provide reliable
information on trends in the female population.

Peninsular Florida Recovery Unit
The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (NMFS and USFWS 2008a). The statewide estimated total for 2012 was 98,601 nests (FWRI nesting database).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. This provides a better tool for understanding the nesting trends (Figure 3.1). FWRI performed a detailed analysis of the long-term loggerhead index nesting data (1989-2012) (http://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead-trends/). Three distinct trends over that time period were identified. From 1989-1998 there was a 23 percent increase, that was then followed by a sharp decline over the subsequent decade. However, recent large increases in loggerhead nesting occurred since then. FWRI examined the trend from the 1998 nesting high through 2012 and found the decade-long post 1998 decline had reversed and there was no longer a demonstrable trend. Looking at the data from 1989 through 2012 FWRI concluded that there was an overall positive change in the nest counts.

![Figure 3.1 Loggerhead sea turtle nesting at Florida index beaches since 1989.](image)

**Northern Recovery Unit**
Annual nest totals from beaches within the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches.
(Georgia Department of Natural Resources (GDNR) unpublished data, North Carolina Wildlife Resources Commission (NCWRC) unpublished data, South Carolina Department of Natural Resources (SCDNR) unpublished data), and represent approximately 1,272 nesting females per year, assuming 4.1 nests per female (Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3 percent annually from 1989-2008. Nest totals from aerial surveys conducted by SCDNR showed a 1.9 percent annual decline in nesting in South Carolina from 1980 through 2008. Overall, there is strong statistical data to suggest the NRU had experienced a long-term decline over that period of time.

Data since that analysis (Table 3.2) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, http://www.georgiawildlife.com/node/3139). South Carolina and North Carolina nesting have also begun to show a shift away from the past declining trend.

Table 3.2 Total number of NRU loggerhead nests (GADNR, SCDNR, and NCWRC nesting datasets)

<table>
<thead>
<tr>
<th>Nests Recorded</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Georgia</td>
<td>1,649</td>
<td>997</td>
<td>1,761</td>
<td>1,992</td>
<td>2,218</td>
</tr>
<tr>
<td>South Carolina</td>
<td>4,500</td>
<td>2,183</td>
<td>3,141</td>
<td>4,015</td>
<td>4,615</td>
</tr>
<tr>
<td>North Carolina</td>
<td>841</td>
<td>276</td>
<td>846</td>
<td>948</td>
<td>1,069</td>
</tr>
<tr>
<td>Total</td>
<td>6,990</td>
<td>3,456</td>
<td>5,748</td>
<td>6,955</td>
<td>7,902</td>
</tr>
</tbody>
</table>

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the from 2009-2012, with 2012 showing the highest index nesting total since the start of the program (Figure 3.2)
Other NW Atlantic DPS Recovery Units

The remaining three recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages but still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida’s statewide survey program. Survey effort was relatively stable during the 9-year period from 1995-2004 (although the 2002 year was missed). Nest counts ranged from 168-270, with a mean of 246, but with no detectable trend during this period (NMFS and USFWS 2008a). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. Analysis of the 12-year dataset (1997-2008) of index nesting beaches in the area shows a statistically significant declining trend of 4.7 percent annually (NMFS and USFWS 2008a). Nesting on the Florida Panhandle index beaches, which represents the majority of NGMRU nesting, had shown a large increase in 2008, but then declined again in 2009 and 2010 before rising back to a level similar to the 2003-2007 average in 2011. Nesting survey effort has been inconsistent among the GCRU nesting beaches and no trend can be determined for this subpopulation. Zurita et al. (2003) found a statistically significant increase in the number of nests on 7 of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. However, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008a).

In-water Trends

Nesting data are the best current indicator of sea turtle population trends; however, in-water data also provide some insight. Such research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in catch per unit effort (CPUE) over the past several years (Ehrhart et al. 2007, Epperly et al. 2007, Arendt et al. 2009). Researchers believe that this increase in CPUE is likely linked to an increase in juvenile abundance, though it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. (Bjornsdal et al. 2005), (cited in NMFS and USFWS (2008a), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature in the near future (TEWG 2009). However, in-water studies throughout the eastern United States also indicate a substantial decrease in the abundance of the smallest oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009).

Population Estimate
The NMFS Southeast Fisheries Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, as well as the western North Atlantic population as a whole, were found to be very similar. The model run estimates, from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggests the adult female population size approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009).

**Threats**

The threats faced by loggerhead sea turtles are well-summarized in the general discussion of threats in Section 3.2.1. However, the impact of fishery interactions is a point of further emphasis for this species. The Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Specific information regarding potential climate change impacts on loggerheads is also available. Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80 percent female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100 percent female offspring. Such highly skewed sex ratios could undermine the reproductive capacity of the species. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most clutches, leading to death (Hawkes et al. 2007b). Warmer sea surface temperatures have also been correlated with an earlier onset of loggerhead nesting in the spring (Hawkes et al. 2007b; Weishampel et al. 2004), as well as short inter-nesting intervals (Hays et al. 2002) and shorter nesting season (Pike et al. 2006).

### 3.2.3 Green Sea Turtle

The green sea turtle was listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered. On September 2, 1998, critical habitat for green sea turtles was designated in coastal waters surrounding Culebra Island, Puerto Rico (63 FR 46693).

**Species Description and Distribution**

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lbs (159 kg) and a straight carapace length of greater than 3.3 ft (1 m). Green sea turtles have a smooth carapace with four pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal
surface and a white ventral surface, although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, or brown and black in starburst or irregular patterns (Lagueux 2001).

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they generally feed on marine algae and seagrasses. They have specific foraging grounds and may make large migrations between these forage sites and natal beaches for nesting (Hays et al. 2001). Green sea turtles nest on sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands in more than 80 countries worldwide (Hirth and USFWS 1997). The two largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica, and Raine Island, on the Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; Fitzsimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species’ range. However, such mixing occurs at extremely low levels in Hawaiian foraging areas, perhaps making this central Pacific population the most isolated of all green sea turtle populations occurring worldwide (Dutton et al. 2008).

In U.S. Atlantic and Gulf of Mexico waters, green sea turtles are distributed in inshore and nearshore waters from Texas to Massachusetts. Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre, and the Gulf inlets of Texas (Doughty 1984; Hildebrand 1982; Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957; Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system in Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (Gusman and Ehrhart 1992; Wershoven and Wershoven 1992). The summer developmental habitat for green sea turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997). Additional important foraging areas in the western Atlantic include the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, scattered areas along Colombia and Brazil (Hirth 1971), and the northwestern coast of the Yucatan Peninsula.

The complete nesting range of green sea turtles within the Southeastern United States includes sandy beaches between Texas and North Carolina, as well as the USVI and Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). However, the vast majority of green sea turtle nesting within the Southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard through Broward counties. For more information on green sea turtle nesting in other ocean basins, refer to the 1991 Recovery Plan for the Atlantic Green Turtle (NMFS and USFWS 1991) or the 2007 Green Sea Turtle 5-Year Status Review (NMFS and USFWS 2007a).
**Life History Information**

Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the Southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July (Witherington and Ehrhart 1989). During the nesting season, females nest at approximately two-week intervals, laying an average of 3-4 clutches (Johnsson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is around 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989). Eggs incubate for approximately two months before hatching. Survivorship at any particular nesting site is greatly influenced by the level of anthropogenic stressors, with the more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed [e.g., Nicaragua (Campbell and Lagueux 2005; Chaloupka and Limpus 2005)]

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007b). Green sea turtles exhibit particularly slow growth rates of about 1-5 centimeters per year (Green 1993; McDonald-Dutton and Dutton 1998), which may be attributed to their largely herbivorous, low-net energy diet (Bjorndal 1982). At approximately 20-25 cm carapace length, juveniles leave the pelagic environment and enter nearshore developmental habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Growth studies using skeletochronology indicate that green sea turtles in the western Atlantic shift from the oceanic phase to nearshore developmental habitats after approximately 5-6 years (Bresette et al. 2006; Zug and Glor 1998). Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel and Ingle 1974). However, some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). Green sea turtles reach sexual maturity at 20-50 years of age (Chaloupka and Musick 1997; Hirth and USFWS 1997), which is considered one of the longest ages to maturity of any sea turtle species.

While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds, and it is clear they are capable of “homing in” on these sites if displaced (McMichael et al. 2003). Reproductive migrations of Florida green sea turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys and in the waters southwest of Cape Sable, with some post-nesting turtles also residing in Bahamian waters as well (NMFS and USFWS 2007b).
Population estimates for marine turtles do not exist because of the difficulty in sampling turtles over their geographic ranges and within their marine environments. However, researchers have used nesting data to study trends in reproducing sea turtles over time. A summary of nesting trends is provided in the most recent 5-year status review for the species (NMFS and USFWS 2007b) organized by ocean region (i.e., Western Atlantic Ocean, Central Atlantic Ocean, Eastern Atlantic Ocean, Mediterranean Sea, Western Indian Ocean, Northern Indian Ocean, Eastern Indian Ocean, Southeast Asia, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). Trends at 23 of the 46 nesting sites and found that 10 appeared to be increasing, 9 appeared to be stable, and 4 appeared to be decreasing. With respect to regional trends, the Pacific, the Western Atlantic, and the Central Atlantic regions appeared to show more positive trends (i.e., more nesting sites increasing than decreasing) while the Southeast Asia, Eastern Indian Ocean, and possibly the Mediterranean Sea regions appeared to show more negative trends (i.e., more nesting sites decreasing than increasing). These regional determinations should be viewed with caution since trend data was only available for about half of the total nesting concentration sites examined in the review and that site specific data availability appeared to vary across all regions.

The Western Atlantic region (i.e., the focus of this opinion) was one of the best performing in terms of abundance in the entire review as there were no sites that appeared to be decreasing. The 5-year status review for the species identified eight geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean and reviewed the trend in nest count data for each (NMFS and USFWS 2007a). These sites include: (1) Yucatán Peninsula, Mexico; (2) Tortuguero, Costa Rica; (3) Aves Island, Venezuela; (4) Galibi Reserve, Suriname; (5) Isla Trindade, Brazil; (6) Ascension Island, United Kingdom; (7) Bioko Island, Equatorial Guinea; and (8) Bijagos Archipelago, Guinea-Bissau. Nesting at all of these sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either (NMFS and USFWS 2007a). Seminoff (2004) likewise reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting, with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic; however, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007a). More information about site specific trends for the other major ocean regions can be found in the most recent 5-year status review for the species (see NMFS and USFWS (2007a)).

By far, the largest known nesting assemblage in the Western Atlantic region occurs at Tortuguero, Costa Rica. According to monitoring data on nest counts, as well as documented emergences (both nesting and non-nesting events), there appears to be an
increasing trend in this nesting assemblage since monitoring began in the early 1970s. For instance, from 1971-1975 there were approximately 41,250 average annual emergences documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 nesting females per year (NMFS and USFWS 2007a). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

In the continental United States, green sea turtle nesting occurs along the Atlantic coast, primarily along the central and southeast coast of Florida where an estimated 200-1,100 females nest each year (Meylan et al. 1994; Weishampel et al. 2003). Occasional nesting has also been documented along the Gulf coast of Florida (Meylan et al. 1995). More recently, green sea turtle nesting has occurred in North Carolina on Bald Head Island, just east of the mouth of the Cape Fear River, on Onslow Island, and on Cape Hatteras National Seashore. In 2010, a total of 18 nests were found in North Carolina, 6 nests in South Carolina, and 6 nests in Georgia (nesting databases maintained on www.seaturtle.org).

In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the ten years of regular monitoring (Figure 3.3). According to data collected from Florida’s index nesting beach survey from 1989-2012, green sea turtle nest counts across Florida have increased approximately tenfold from a low of 267 in the early 1990s to a high of 10,701 in 2011. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in both 2010 and 2011 (Figure 3.3). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more reported an estimate of the green turtle nesting assemblages at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent.
Figure 3.3 Green sea turtle nesting at Florida index beaches since 1989.

**Threats**

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat in some areas. Green sea turtles also face many of the same threats as other sea turtle species, including ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals, etc.), poaching, global climate change, fisheries bycatch and disease. A discussion on general sea turtle threats can be found in Section 3.2.1.

In addition to general threats, green sea turtles are susceptible to mortality from Fibropapillomatosis (FP) disease. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) of turtles (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.1 cm to greater than 30 cm in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, though it is believed to be related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions [e.g., habitat degradation, pollution, low wave energy, and shallow water (Foley et al. 2005)]. Presently, FP is cosmopolitan, but has been found to affect large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).
Cold-stunning is another natural threat to green sea turtles. Although it is not considered a major source of mortality in most cases, as temperatures fall below 8°-10°C, turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles being found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, and approximately 1,030 were rehabilitated and released. Additionally, during this same time frame, approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

3.2.4 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act of 1969. On September 26, 1978, USFWS designated critical habitat for leatherback sea turtles as the terrestrial environment of Sandy Point, St. Croix, U.S. V.I. (43 FR 43688). On March 23, 1979, NMFS designated critical habitat for leatherback sea turtles as the waters adjacent to Sandy Point, St. Croix, U.S.V.I. from the 183 m isobath to mean high tide level between 17° 42'12" N and 65°50'00" W (44 FR 17710). Then on January 26, 2012, NMFS revised the critical habitat designation for leatherback sea turtles to include coastal and open water areas along the U.S. West Coast (77 FR 4170).

Species Description and Distribution

The leatherback is the largest sea turtle in the world, with a curved carapace length (CCL) often exceeding 5 ft (150 cm) and front flippers that can span almost 9 ft (270 cm) (NMFS and USFWS 1998b). Mature males and females can reach lengths of over 6 ft (2 m) and weigh close to 2,000 lbs (900 kg). Leatherbacks do not have an outer bony shell. A leatherback’s shell is approximately 1.5 inches (4 cm) thick and consists of a leathery, oil-saturated connective tissue overlaying loosely interlocking dermal bones. The ridged shell and large flippers help the leatherback during long-distance trips in search of food.

Leatherbacks are circumglobally distributed and are found in tropical, subtropical, and temperate waters. Leatherbacks have several unique traits that enable them to live in cold water, unlike other sea turtles. For example, leatherbacks have a countercurrent circulatory system (Greer et al. 1973), a thick layer of insulating fat (Davenport et al. 3 Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body surface.

3
and they can increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS-SEFSC 2001). Leatherbacks have pointed toothlike cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey, such as jellyfish and salps. A leatherback’s mouth and throat also have backward-pointing spines that help retain jelly-like prey. Primary prey (e.g., medusae, siphonophores, and salps), occur commonly in temperate and boreal latitudes and prey distribution likely has a strong influence on leatherback distribution in these areas (Plotkin 1995). Leatherbacks are known to be deep divers, with recorded depths in excess of a half mile (Eckert et al. 1989), but the species also regularly inhabits shallow waters to locate prey items.

Genetic analyses using microsatellite markers along with mitochondrial DNA and tagging data indicate there are seven groups or breeding populations in the Atlantic Ocean: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages, although data to support this is limited in most cases.

**Life History Information**

Leatherback life history follows the same general patterns as do all sea turtles – long-lived, late-maturing, with low annual survival during the early life stages and high annual survival in the latter life stages. While a robust estimate of the leatherback sea turtle’s life span does not exist, the current best estimate for the maximum age is 43 (Avens et al. 2009). It is still unclear when leatherbacks first become sexually mature. Using skeletochronological data, Avens et al. (2009) estimated that leatherbacks in the western North Atlantic may not reach maturity until 29 years of age, which is longer than earlier estimates by Pritchard and Trebbau (1984): 2-3 years; Rhodin (1985): 3-6 years; Zug and Parham (1996): 13-14 years for females; and Dutton et al. (2005): 12-14 years for leatherbacks nesting in the U.S. Virgin Islands).

The average size of reproductively active females in the Atlantic is generally 5-5.5 ft (150-162 cm) CCL (Benson et al. 2007a; Hirth et al. 1993; Starbird and Suarez 1994). However, females as small as 3.5-4 ft (105-125 cm) CCL have been observed nesting at various sites (Stewart et al. 2007).

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2 to 4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8 to 12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert et al. 1989; Maharaj 2004; Matos 1996; Stewart and Johnson 2006; Tucker

As the warm blood flows away from the heart it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body core

4 “Gigantothermy” refers to a condition when an animal has relatively high volume compared to its surface area, and as a result, it losses less heat.
Individual female leatherbacks have been observed to reproduce as long as 25 years (Hughes 1996; D. Dutton, Ocean Planet Research, Inc., August 2009, pers. comm., in NMFS 2012). Apparently unique to leatherbacks, up to approximately 30 percent of the eggs within a clutch may be infertile (Eckert et al. 1989; Maharaj 2004; Matos; Stewart and Johnson 2006; Tucker 1988). Hatchling emergence success is approximately 50 percent worldwide (Eckert et al. 2012) but is between 54-72 percent in the United States (Eckert and Eckert 1990; Stewart and Johnson 2006; Tucker 1988). Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings are approximately 20-30 inches (50-77 cm) in length, with fore flippers as long as their bodies, and weigh approximately 1.5-2 ounces (40-50 g). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year, some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert et al. 1989; Keinath and Musick 1993; Steyermark et al. 1996).

In the Atlantic Basin, the sex ratio appears to be skewed toward females. The TEWG (2007) reports that stranding data from the U.S. Atlantic and Gulf of Mexico indicate that 60 percent of strandings were females. Those data also show that the proportion of females among adults (57 percent) and juveniles (61 percent) was also skewed toward females in these areas (TEWG 2007). James et al. (2007) collected size and sex data from large sub-adult and adult leatherbacks off Nova Scotia and also concluded a bias toward females at a rate of 1.86:1.

The survival and mortality rates for leatherbacks are difficult to estimate and vary by location. For example, the annual mortality rate for leatherbacks that nested at Playa Grande, Costa Rica, was estimated to be 34.6 percent in 1993-1994 and 34.0 percent in 1994-1995 (Spotila et al. 2000). In contrast leatherbacks nesting in French Guiana and St. Croix had estimated annual survival rates of 91 percent (Rivalan et al. 2005) and 89 percent (Dutton et al. 2005), respectively. For the St. Croix population, the average annual juvenile survival rate was estimated to be approximately 63 percent, and the total survival rate from hatching to first year of reproduction for a female was estimated to be between 0.4 and 2 percent [assuming age at first reproduction is between 9 and 13 years (Eguchi et al. 2006)]. Spotila et al. (1996a) estimated first year survival rates for leatherbacks at 6.25 percent.

Migratory routes of leatherbacks are not entirely known. However, recent information from satellite tags have documented long travels between nesting beaches and foraging areas in the Atlantic and Pacific Ocean basins (Benson et al. 2007a; Benson et al. 2011; Eckert 2006a; Eckert et al. 2006; Ferraroli et al. 2004; Hays et al. 2004; James et al. 2005). Leatherbacks nesting in Central America and Mexico travel thousands of miles into tropical and temperate waters of the South Pacific (Eckert and Sarti 1997; Shillinger et al. 2008). Data from satellite tagged leatherbacks suggest that they may be traveling in search of seasonal aggregations of jellyfish (Benson et al. 2007b; Bowlby et al. 1994; Graham 2009; Shenker 1984; Starbird et al. 1993; Suchman and Brodeur 2005).

*Status and Population Dynamics*
The status of the Atlantic leatherback population has been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Santidrián-Tomillo et al. 2007; Sarti Martínez et al. 2007; Spotila et al. 2000). This uncertainty has been a result of inconsistent beach and aerial surveys, cycles of erosion and reformation of nesting beaches in the Guianas (representing the largest nesting area). Leatherbacks also show a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species. However, coordinated efforts of data collection and analyses by the Leatherback Turtle Expert Working Group have helped to clarify the understanding of the Atlantic population status (TEWG 2007).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with most of the nesting occurring in the Guianas and Trinidad. The Southern Caribbean/Guianas stock of leatherbacks was designated after genetics studies indicated that animals from the Guianas (and possibly Trinidad) should be viewed as one population. Using nesting females as a proxy for population, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate. This positive growth was seen within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007).

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986 the number of leatherback nests in French Guiana had increased by about 15 percent annually (NMFS-SEFSC 2001). This was then followed by a nesting decline of about 15 percent annually. This decline corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schultz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname. These increases were happening at the same time the number of nests was declining at beaches that had previously shown large increases in nesting (Hilterman et al. 2003) thought this information suggested the long-term trend for the overall Suriname and French Guiana population was increasing.

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting here is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coast of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicate that the nesting population likely was not growing over the 1995-2005 time series (TEWG 2007).

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5 Leatherback nesting in Suriname increased by more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001.
Other modeling of the nesting data for Tortuguero indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng et al. 2007).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (USVI), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1 percent (TEWG 2007). At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has varied from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1 percent from 1986-2004 (TEWG 2007). Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2 percent between 1994 and 2004 (TEWG 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (TEWG 2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. FWC Index Nesting Beach Survey Data indicates biennial peaks in nesting abundance beginning in 2007 (Figure 3.4 and Table 3.3). A similar pattern was also observed statewide (Table 3.3). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend shows growth on Florida’s east coast beaches.

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The West African nesting stock of leatherbacks is large and important, but is a mostly unstudied aggregation. Nesting occurs in various countries along Africa’s Atlantic coast, but much of the nesting is undocumented and the data are inconsistent. Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in one season (Fretey et al. 2007). Fretey et al. (2007) also provide detailed information about other known nesting beaches and survey efforts along the Atlantic African coast. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

Two other small but growing stocks nest on the beaches of Brazil and South Africa. Based on the data available, TEWG (2007) determined that between 1988 and 2003 there was a positive annual average growth rate between 1.07 and 1.08 percent for the Brazilian stock. TEWG (2007) estimated an annual average growth rate between 1.04 and 1.06 percent for the South African stock. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

Because the available nesting information is inconsistent it is difficult to estimate the total population size for Atlantic leatherbacks. Spotila et al. (1996b) characterized the entire Western Atlantic population as stable at best. They estimated the numbers of nesting females was likely around 18,800 (Spotila et al. 1996b). A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the Western Atlantic nesting levels had decreased to about 15,000 females. Spotila et al. (1996b) estimated that the adult female leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (considering both nesting and interesting females), with an estimated range of 20,082-35,133. This is consistent
with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007).

**Threats**

Leatherbacks face many of the same threats as other sea turtle species including, fisheries bycatch, ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, and global climate change. A discussion on general sea turtle threats can be found in Section 3.2.1; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact leatherback sea turtles.

Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines. This may be because of their body type (large size, long pectoral flippers, and lack of a hard shell) and/or their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine and many other stranded individuals exhibited evidence of prior entanglement (Dwyer et al. 2002). Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations and represents a significant threat to survival and recovery of the species worldwide.

Leatherback sea turtles may also be more susceptible to marine debris ingestion than other sea turtle species due to their predominantly oceanic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding and migratory purposes (Lutcavage et al. 1997; Shoop and Kenney 1992). The stomach contents of leatherback sea turtles revealed that a substantial percentage (33.8 percent; 138 of 408 cases examined) contained some form of plastic debris (Mrosovsky et al. 2009). Plastic blocking the gut to an extent that could have caused death was evident in 8.7 percent of all leatherbacks that ingested plastic (Mrosovsky et al. 2009). Mrosovsky et al. (2009) also note that in a number of cases, the ingestion of plastic may not cause death outright, but could cause the animal to absorb fewer nutrients from food, eat less in general, etc., all of which could cause other adverse effects. The presence of plastic in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and forms of debris such a plastic bags (Mrosovsky et al. 2009). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size or even movement as it drifts about, and induce a feeding response in leatherbacks.

Global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007d). Several studies have shown leatherback distribution is influenced by jellyfish abundance (e.g., (Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006).
### 3.2.5 Hawksbill Sea Turtle


**Species Description and Distribution**

The hawksbill sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Hawksbill sea turtles are small to medium-sized (99 to 150 lb on average [45 to 68 kg]) although nesting females are known to weigh up to 176 lb (80 kgs) in the Caribbean (Pritchard et al. 1983). The carapace is usually serrated and has a "tortoise-shell" coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The plastron of a hawksbill turtle is typically yellow. The head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. The shape of the mouth allows the hawksbill turtle to reach into holes and crevices of coral reefs to find sponges, their primary food source as adults, and other invertebrates. The shells of hatchlings are 1.7 in (42 mm) long, are mostly brown, and somewhat heart-shaped (Eckert 1995; Hillis and Mackay 1989; Van Dam and Sarti 1989).

Hawksbill sea turtles have a circumtropical distribution and usually occur between latitudes 30°N and 30°S in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, hawksbills are widely distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental United States, in the Greater and Lesser Antilles, and along the mainland of Central America south to Brazil (Amos 1989; Groombridge and Luxmoore 1989; Lund 1985; Meylan and Donnelly 1999; NMFS and USFWS 1998b; Plotkin and Amos 1988; Plotkin and Amos 1990). They are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Adult hawksbill sea turtles are capable of migrating long distances between nesting beaches and foraging areas. For instance, a female hawksbill sea turtle tagged at Buck Island Reef National Monument (BIRNM) was later identified 1,160 miles (1,866 km) away in the Miskito Cays in Nicaragua (Spotila 2004).

Hawksbill sea turtles nest on sandy beaches throughout the tropics and subtropics. Nesting occurs in at least 70 countries, although much of it now only occurs at low densities compared to other sea turtle species (NMFS and USFWS 2007b). (Meylan and Donnelly 1999) believe that the widely dispersed nesting areas and low nest densities is likely a result of overexploitation of previously large colonies that have since been depleted over time. The most significant nesting within the United States occurs in Puerto Rico and the U.S. Virgin Islands, specifically on Mona Island and BIRNM, respectively. Although nesting within the continental United States is typically rare, it can also occur along the southeast coast of Florida and the Florida Keys. The largest
hawksbill nesting population in the Western Atlantic occurs in the Yucatán Peninsula of Mexico, where several thousand nests are recorded annually in the states of Campeche, Yucatán, and Quintana Roo (Garduno-Andrade et al. 1999; Spotila 2004). In the U.S. Pacific, hawksbills nest on main island beaches in Hawaii, primarily along the east coast of the island. Hawksbill nesting has also been documented in American Samoa and Guam. More information on nesting in other ocean basins may be found in the 5-year status review for the species (NMFS and USFWS 2007b).

Mitochondrial DNA studies show that reproductive populations are effectively isolated over ecological time scales (Bass et al. 1996). Substantial efforts have been made to determine the nesting population origins of hawksbill sea turtles assembled in foraging grounds, and genetic research has shown that hawksbills of multiple nesting origins commonly mix in foraging areas (Bowen et al. 1996). Since hawksbill sea turtles nest primarily on the beaches where they were born, if a nesting population is wiped out it might not be replenished by sea turtles from other nesting rookeries (Bass et al. 1996).

Life History Information
Hawksbill sea turtles exhibit slow growth rates although they are known to vary within and among populations from a low of 0.4-1.2 in (1-3 cm) per year measured in the Indo-Pacific (Chaloupka and Limpus 1997; Mortimer et al. 2003; Mortimer et al. 2002; Whiting 2000) to a high of 2 in (5 cm) or more per year measured at some sites in the Caribbean (Díez and van Dam 2002; León and Díez 1999). Differences in growth rates are likely due to differences in diet and/or density of sea turtles at foraging sites and overall time spent foraging (Bjorndal et al. 2000; Chaloupka et al. 2004). Consistent with slow growth, age to maturity for the species is also long, taking between 20 and 40 years depending on the region (Chaloupka and Musick 1997; Limpus and Miller 2000). Hawksbills in the western Atlantic are known to mature faster (i.e. 20 or more years) than sea turtles found in the Indo-Pacific (i.e. 30-40 years) (Boulan 1983; Boulon 1994; Díez and van Dam 2002; Limpus and Miller 2000). Males are typically mature when their length reaches 27 in (69 cm) while females are typically mature at 30 in (75 cm) (Eckert et al. 1992; Limpus 1992). Female hawksbills return to their natal (site of their birth) beaches every 2-3 years to nest (van Dam et al. 1991; Witzell 1983) and generally lay 3-5 nests per season (Richardson et al. 1999). Compared with other sea turtles, the number of eggs per nest (clutch) for hawksbills can be quite high. The largest clutches recorded for any sea turtle belong to hawksbills (approximately 250 eggs per nest) (Hirth and Abdel Latif 1980), though nests in the U.S. Caribbean and Florida more typically contain approximately 140 eggs (USFWS hawksbill fact sheet, http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/hawksbill-sea-turtle.htm). Eggs incubate for approximately 60 days before hatching (USFWS hawksbill fact sheet).

Hawksbills may undertake developmental migrations (migrations as immatures) and reproductive migrations that involve travel over many tens to thousands of miles (Meylan 1999a). Post-hatchlings (oceanic stage juveniles) are believed to live in the open ocean, taking shelter in floating algal mats and drift lines of flotsam and jetsam in the Atlantic and Pacific oceans (Musick and Limpus 1997) before returning to more coastal foraging.
grounds. In the Caribbean, hawksbills are known to almost exclusively feed on sponges (Meylan 1988; van Dam and Diez 1997) although at times they have been seen foraging on other food items, notably corallimorphs and zooanthids (León and Diez 2000; Mayor et al. 1998; van Dam and Diez 1997).

Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest and exhibit a high degree of fidelity to their nest sites. Movements of reproductive males are less certain, but are presumed to involve migrations to nesting beaches or to courtship stations along the migratory corridor. Hawksbills show a high fidelity to their foraging areas as well (van Dam and Diez 1998). Foraging sites are typically areas associated with coral reefs although hawksbills are also found around rocky outcrops and high energy shoals which are optimum sites for sponge growth. They can also inhabit seagrass pastures in mangrove-fringed bays and estuaries, particularly along the eastern shore of continents where coral reefs are absent (Bjorndal 1997; van Dam and Diez 1998).

**Status and Population Dynamics**

There are currently no reliable estimates of population abundance and trends for non-nesting hawksbills at the time of this consultation; therefore, nesting beach data is currently the primary information source for evaluating trends in global abundance. Most hawksbill populations around the globe are either declining, depleted, and/or remnants of larger aggregations (NMFS and USFWS 2007b). The largest nesting population of hawksbills occurs in Australia where approximately 2,000 hawksbills nest off the northwest coast and about 6,000 to 8,000 nest off the Great Barrier Reef each year (Spotila 2004). Additionally, about 2,000 hawksbills nest each year in Indonesia and 1,000 nest in the Republic of Seychelles (Spotila 2004). In the United States, about 500-1,000 hawksbill nests were typically laid on Mona Island, Puerto Rico in the past (Diez and van Dam 2007), but the numbers appear to be increasing, as nearly 1,600 nests were counted by Puerto Rico Department of Natural and Environmental Resources in 2010 (PRDNER nesting data). Another 56-150 nests are typically laid on Buck Island off St. Croix (Meylan 1999b; Mortimer and Donnelly 2008). Nesting also occurs to a lesser extent on beaches on Culebra Island and Vieques Island in Puerto Rico, the mainland of Puerto Rico, and additional beaches on St. Croix, St. John, and St. Thomas.

Mortimer and Donnelly (2008) reviewed nesting data for 83 nesting concentrations organized among 10 different ocean regions (i.e. Insular Caribbean, Western Caribbean Mainland, Southwestern Atlantic Ocean, Eastern Atlantic Ocean, Southwestern Indian Ocean, Northwestern Indian Ocean, Central Indian Ocean, Eastern Indian Ocean, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). Historic trends (i.e., 20-100 years ago) were determined for 58 of the 83 sites while recent abundance trends (i.e., within the past 20 years) were also determined for 42 of the 83 sites. Among the 58 sites where historic trends could be determined, all showed a declining trend during the long term period. Among the 42 sites where recent trend data were available, 10 appeared to be increasing, 3 appeared to be stable, and 29 appeared to be decreasing. With respect to regional trends, nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland) are generally
doing better than those in the Indo-Pacific regions. For instance, 9 of the 10 sites that showed recent increases are located in the Caribbean. Buck Island and St. Croix’s East End beaches support two remnant populations of between 17-30 nesting females per season (Hillis and Mackay 1989; Mackay 2006). While the proportion of hawksbills nesting on Buck Island represents a small proportion of the total hawksbill nesting occurring in the greater Caribbean region, Mortimer and Donnelly (2008) report an increasing trend in nesting at that site based on data collected from 2001-2006. This increase is likely due to the conservation measures implemented when BIRNM was expanded in 2001.

Nesting concentrations in the Pacific Ocean appear to be performing the worst of all regions despite the fact that the region currently supports more nesting hawksbills than either the Atlantic or Indian Oceans (Mortimer and Donnelly 2008). However, while still critically low in numbers, sightings of hawksbills in the eastern Pacific appear to have been increasing since 2007, though some of that increase may be attributable to better observations (Gaos et al. 2010). More information about site specific trends can be found in the most recent five year status review for the species [see (NMFS and USFWS 2007b)].

**Threats**

Hawksbills are currently subjected to the same suite of threats on both nesting beaches and in the marine environment that affect other sea turtles (e.g. interaction with fisheries, coastal construction, oil spills, climate change affecting sex ratios, etc.) as discussed in Section 3.2.1. There are also specific threats that are of special emphasis, or are unique, for hawksbill sea turtles discussed in further detail below.

The historical decline of the species is primarily attributed to centuries of exploitation for the beautifully patterned shell, which made it a highly attractive species to target (Parsons 1972). The fact that reproductive females exhibit a high fidelity for nest sites and the tendency of hawksbills to nest at regular intervals within a season made them an easy target for capture on nesting beaches. The shells from hundreds of thousands of sea turtles in the western Caribbean region were imported into the United Kingdom and France during the 19th and early 20th centuries (Parsons 1972) and additional hundreds of thousands of sea turtles contributed to the region’s trade with Japan prior to 1993 when a zero quota was imposed [(Milliken and Tokunaga 1987) as cited in (Brautigam and Eckert 2006)].

The continuing demand for the hawksbill's shell, as well as other products (leather, oil, perfume, and cosmetics), represents an ongoing threat to recovery of the species. The British Virgin Islands, Cayman Islands, Haiti, and the Turks and Caicos Islands (U.K.) all permit some form of legal take of hawksbill sea turtles. In the northern Caribbean, hawksbills continue to be illegally harvested for their shells, which are often carved into hair clips, combs, jewelry, and other trinkets (Márquez M 1990; Stapleton and Stapleton 2006). Additionally, hawksbills are harvested for their eggs and meat while whole, stuffed sea turtles are sold as curios in the tourist trade. Also, hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica despite a
prohibition on harvesting hawksbills and their eggs (Fleming 2001). International trade in the shell of this species is prohibited between countries that have signed the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), but illegal trade is still occurring and remains an ongoing threat to hawksbill survival and recovery throughout its range.

Due to their preference to feed on sponges associated with coral reefs, hawksbill sea turtles are particularly sensitive to losses of coral reef communities. Coral reefs are vulnerable to destruction and degradation caused by human activities (e.g., nutrient pollution, sedimentation, contaminant spills, vessel groundings and anchoring, recreational uses, etc.) and are also highly sensitive to the effects of climate change (e.g., higher incidences of disease and coral bleaching) (Crabbe 2008; Wilkinson 2004). Continued loss of coral reef communities (especially in the greater Caribbean region) is expected to impact foraging and represents a major threat to the recovery of the species.

3.2.6 Kemp’s Ridley Sea Turtle

The Kemp’s ridley sea turtle was listed as endangered on December 2, 1970, under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Internationally, the Kemp’s ridley is considered the most endangered sea turtle (Groombridge 1982; TEWG 2000b; Zwinenberg 1977).

Species Description
The Kemp’s ridley sea turtle is the smallest of all sea turtles. Hatchlings generally range from 1.65-1.89 in (42-48 mm) in straight-line carapace length (SCL), 1.26-1.73 in (32-44 mm) in width, and 0.3-0.4 lb. (15-20 g) in weight. Adults generally weigh less than 100 lb. (45 kg) and have a carapace length of around 2.1 ft. (65 cm). Adult Kemp’s ridley shells are almost as wide as they are long. Coloration changes significantly during development from the grey-black dorsum and plastron of hatchlings, a grey-black dorsum with a yellowish-white plastron as post pelagic juveniles, and then to the lighter grey-olive carapace and cream-white or yellowish plastron of adults. There are 2 pairs of prefrontal scales on the head, 5 vertebral scutes, usually 5 pairs of costal scutes, and generally 12 pairs of marginal scutes on the carapace. In each bridge adjoining the plastron to the carapace, there are four scutes, each of which is perforated by a pore.

Kemp’s ridley habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 ft. (37 m) deep, although they can also be found in deeper offshore waters. These areas support the primary prey species of the Kemp’s ridley sea turtle, which consist of swimming crabs, but may also include fish, jellyfish, and an array of mollusks.

The primary range of Kemp’s ridley sea turtles is within the Gulf of Mexico basin, with substantial numbers also inhabiting coastal and offshore waters of the U.S. Atlantic Ocean. Juvenile Kemp’s ridley sea turtles, possibly carried by oceanic currents, have been recorded as far north as Nova Scotia. Historic nesting records range from Mustang Island, Texas, in the north, to Veracruz, Mexico, in the south. As the population has
grown, a few Kemp’s ridley nests have been discovered along the Atlantic Coast of the United States, with nests recorded from beaches in Florida, Georgia, and the Carolinas. In 2012, the first Kemp’s ridley sea turtle nest was recorded in Virginia.

Life History Information
Kemp’s ridleys share a general life history pattern similar to other sea turtles. Females lay their eggs on coastal beaches where the eggs incubate in sandy nests. After 45-58 days of embryonic development, the hatchlings emerge and swim offshore into deeper, ocean water where they feed and grow until recruiting to neritic waters at or near 20 cm in carapace length. The return to nearshore coastal habitats typically occurs around 2 years of age (Ogren 1989), although the time spent in the oceanic zone may vary from 1-4 years or perhaps more (TEWG 2000). Growth rates generally fall within 5.5-7.5 ± 6.2 cm/year (Schmid and Barichivich 2006; Schmid and Woodhead 2000). Estimates of age to sexual maturity range from 5-16 years, though NMFS et al. (2011) determined the best estimate of age to maturity for Kemp’s ridley sea turtles was 12 years. It is unlikely that most adults grow very much after maturity. While some sea turtles nest annually, the weighted mean remigration rate for Kemp’s ridley sea turtles is approximately two years. Nesting generally occurs from April to July and females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M 1994).

Population Dynamics
Most of the population nests on the beaches of Rancho Nuevo, Mexico (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, however, nesting numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000 (with a low of 702 nests in 1985). Since then, nesting began to gradually increase through the 1990s, and then accelerated during the first decade of the 21st century (Figure 3.5). From 1978 to 1988, only Rancho Nuevo nests were recorded. In 1988, nesting data from southern beaches at Playa Dos and Barra del Tordo were added, in 1989, data from the northern beaches of Barra Ostionales and Tepehuajes were added, and, most recently in 1996, data from La Pesca and Altamira beaches were recorded. Currently, nesting at Rancho Nuevo accounts for just over 81 percent of all recorded Kemp’s ridley nests in Mexico. Kemp’s ridley nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo nesting database 2013). Small numbers of Kemp’s ridleys also nest in Texas, and the number of nests laid in Texas has risen similarly to the gradual increase in nests at the primary nesting beaches in Mexico. A record high of 209 nests were recorded in Texas in 2012 (National Park Service data http://www.nps.gov/pais/naturescience/strp.htm, http://www.nps.gov/pais/naturescience/current-season.htm).
The increases in Kemp’s ridley sea turtle nesting over the last two decades is likely due to the implementation of TEDs in the U.S. and Mexico and the near complete nest and nesting female protection at the main nesting beaches. While these results are encouraging, the species limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty.

**Threats**

Kemp’s ridleys face many of the same threats as other sea turtle species, including fisheries bycatch, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), and global climate change. A discussion on general sea turtle threats can be found in Section 3.2.1; the remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp’s ridley sea turtles.

Over the past three years, NMFS has documented (via the Sea Turtle Stranding and Salvage Network data, [http://www.sefsc.noaa.gov/species/turtles/strandings.htm](http://www.sefsc.noaa.gov/species/turtles/strandings.htm)) elevated sea turtle strandings in the Northern Gulf of Mexico, particularly throughout the Mississippi Sound area. In the first three weeks of June 2010, over 120 sea turtle strandings were reported from Mississippi and Alabama waters, none of which exhibited any signs of external oiling to indicate effects associated with the DWH oil spill event. A total of 644 sea turtle strandings were reported in 2010 from Louisiana, Mississippi, and Alabama waters, 561 (87 percent) of which were Kemp’s ridley sea turtles. During
March through May of 2011, 267 sea turtle strandings were reported from Mississippi and Alabama waters alone. A total of 525 sea turtle strandings were reported in 2011 from Louisiana, Mississippi, and Alabama waters, with the majority (455) occurring from March through July, 390 (86 percent) of which were Kemp’s ridley sea turtles. During 2012, a total of 428 sea turtles were reported from Louisiana, Mississippi, and Alabama waters, though the data is incomplete. Of these reported strandings, 301 (70 percent) were Kemp’s ridley sea turtles. These stranding numbers are significantly greater than reported in past years; Louisiana, Mississippi, and Alabama waters reported 42 and 73 sea turtle strandings for 2008 and 2009, respectively; however, it should be noted that stranding coverage had increased considerably since the DWH oil spill event in 2010. Nonetheless, considering that strandings typically represent only a small fraction of actual mortality, these mortalities represent a serious impediment to the recovery and survival of the species. While a definitive cause for these strandings has not been identified, necropsy results indicate a significant number of stranded turtles from these events likely perished due to forced submergence, which is commonly associated with fishery interactions (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS, 2012). Given the nesting trends and habitat use of Kemp’s ridley sea turtles, it is likely that fishery interactions in the Northern Gulf of Mexico may continue to be an issue of concern for the species, and one that may potentially slow the rate of recovery for Kemp’s ridley sea turtles.

4. Environmental Baseline

By regulation, environmental baselines for 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 affecting the survival and recovery of ESA-listed green, Kemp’s ridley, hawksbill, leatherback, and loggerhead sea turtles in the action area. The environmental baseline focuses primarily on past and present impacts to these species.

The following discussion summarizes the natural and human phenomena in the action area that may affect the likelihood these species will survive and recover in the wild. These include predation, cold stunning, beach erosion, disease and parasites, fisheries interactions, habitat degradation and climate change, marine debris, poaching, contaminants, vessel strikes, scientific research, lack of international protection, and conservation and management efforts.

4.1 Natural sources of stress and mortality
**Predation**
While in the water, sea turtles face predation primarily by sharks (Pitman and Dutton 2004). Tiger sharks (*Galeocerdo cuvieri*) and bull sharks (*Carcharhinus leucas*) are the species most often reported to contain sea turtle remains (Compagno 1984, Simpfendorfer et al. 2001, Witzell 1987). Hatchlings are preyed upon by herons, gulls, large bony fish, and sharks. Land predators (primarily of eggs and hatchlings) include dogs, pigs, rats, crabs, sea birds, reef fishes, groupers, feral cats, and foxes (Bell et al. 1994, Ficetola 2008). In some areas, nesting beaches can be almost completely destroyed and all nests can sustain some level of depredation (Ficetola 2008).

**Natural beach erosion**
Natural beach erosion events may influence the quality of nesting habitat in the action area. Nesting females may deposit eggs at the base of an escarpment formed during an erosion event where they are more susceptible to repeated tidal inundation. Erosion, frequent or prolonged tidal inundation, and accretion can negatively affect incubating egg clutches. Short-term erosion events (e.g., atmospheric fronts, northeasters, tropical storms, and hurricanes) are common phenomena throughout sea turtles’ nesting range and may vary considerably from year to year. Sea turtles have evolved a strategy to offset these natural events by laying large numbers of eggs and by distributing their nests both spatially and temporally. Thus, the total annual hatching production is never fully affected by storm-generated beach erosion and inundation, although local effects may be high. Leatherback hatching success is particularly sensitive to nesting site selection, as nests that are overwashed have significantly lower hatching success and leatherbacks nest closer to the high-tide line than other sea turtle species (Caut et al. 2009).

**Disease and parasites**
Diseases caused by bacteria, fungus, and viruses affect sea turtles in the action area. Sea turtles are also found to have endo- and ectoparasites. Fibropapilloma (possibly viral in origin) is a major threat to listed turtles in many areas of the world. The disease is characterized by tumorous growths, which can range in size from very small to extremely large, and are found both internally and externally. Large tumors can interfere with feeding and essential behaviors, and tumors on the eyes can cause permanent blindness (Foley et al. 2005). For unknown reasons, the frequency of fibropapillomatosis is much higher in green sea turtles than in other species and may be a threat to numerous existing subpopulations.

At least two bacterial diseases have been described in wild loggerhead populations, including bacterial encephalitis and ulcerative stomatitis/obstructive rhinitis/pneumonia (George 1997), and *Bartonella* was recently reported in wild loggerheads from North Carolina (Valentine et al. 2007). There are few reports of fungal infections in wild loggerhead populations. Homer et al. (2000) documented systemic fungal infections in stranded loggerheads in Florida.

Parasites also affect sea turtles in the action area. For example, a variety of endoparasites, including trematodes, tapeworms, and nematodes have been described in
loggerheads (Herbst and Jacobson 1995). Heavy infestations of endoparasites may cause
or contribute to debilitation or mortality in sea turtles. Trematode eggs and adults were
seen in a variety of tissues including the spinal cord and brain of debilitated loggerheads
during an epizootic in South Florida during late 2000 and early 2001. These were
implicated as a possible cause of the epizootic (Jacobson et al. 2006).

Ectoparasites, including leeches and barnacles, may have debilitating effects on
loggerheads. Large marine leech infestations may result in anemia and act as vectors for
other disease producing organisms (George 1997). Barnacles are generally considered
innocuous although some burrowing species may penetrate the body cavity resulting in
mortality (Herbst and Jacobson 1995). Green sea turtles with an abundance of barnacles
have been found to have a much greater probability of having health issues (Flint et al.
2009). Heavy loads of barnacles are associated with unhealthy or dead stranded
loggerheads (Deem et al. 2009).

Although many health problems have been described in wild populations through the
necropsy of stranded turtles, the significance of diseases on the ecology of wild
populations is not known (Herbst and Jacobson 1995). However, several researchers
have initiated health assessments to study health problems in free-ranging turtle
populations.

Cold stunning
All sea turtles except leatherbacks can undergo “cold stunning” if water temperatures
drop below a threshold level, which can be lethal. Kemp’s ridley sea turtles are
particularly prone to this phenomenon along Cape Cod (Innis et al. 2009).

4.2 Anthropogenic sources of stress and mortality

Fisheries interactions
Fisheries interactions are the largest in-water threat to sea turtle recovery. Wallace et al.
(2010) estimated that between 1990 and 2008, at least 85,000 sea turtles were captured as
bycatch in fisheries worldwide. This estimate is likely at least two orders of magnitude
low, resulting in a likely bycatch of nearly half a million sea turtles annually (Wallace et
al. 2010).

Of all commercial and recreational fisheries in the U.S., shrimp trawling is the most
detrimental to the recovery of sea turtle populations. In a 1990 study, the National
Academy of Sciences estimated that between 5,000 and 50,000 loggerheads were killed
annually by the offshore shrimping fleet in the southeast U.S. Atlantic and Gulf of
Mexico (National Research Council 1990). Mortality associated with shrimp trawls was
estimated to be 10 times greater than that of all other human-related factors combined
(National Research Council 1990). Most of these turtles were neritic juveniles, the life
stages most critical to the stability and recovery of sea turtle populations (Crouse et al.
1987, Crowder et al. 1994).

Habitat degradation and climate change
Coastal development can deter or interfere with nesting, affect nest success, and degrade foraging habitats for sea turtles. Many nesting beaches have already been significantly degraded or destroyed. Nesting habitat is threatened by rigid shoreline protection or “coastal armoring” such as sea walls, rock revetments, and sandbag installations. Many miles of once productive nesting beach have been permanently lost to this type of shoreline protection. Nesting habitat can be reduced by beach nourishment projects, which result in altered beach and sand characteristics, affecting nesting activity and nest success. Beach nourishment also hampers nesting success of loggerhead sea turtles, but only in the first year post-nourishment, after which hatching success increases (Brock et al. 2009). In some areas, timber and marine debris accumulation as well as sand mining reduce available nesting habitat (Bourgeois et al. 2009). Because hawksbills prefer to nest under vegetation (Horrocks and Scott 1991, Mortimer 1982), they are particularly affected by beachfront development and clearing of dune vegetation (Mortimer and Donnelly 2007).

The presence of lights on or adjacent to nesting beaches alters the behavior of nesting adults and is often fatal to emerging hatchlings as they are attracted to light sources and drawn away from the sea (Witherington 1992, Witherington and Bjorndal 1991). Coasts can also be threatened by contamination from herbicides, pesticides, oil spills, and other chemicals, as well as structural degradation from excessive boat anchoring and dredging (Waycott et al. 2005, Lee Long et al. 2000, Francour et al. 1999).

At sea, there are numerous potential threats to sea turtles including marine pollution, oil and gas exploration, lost and discarded fishing gear, changes in prey abundance and distribution due to commercial fishing, habitat alteration and destruction caused by fishing gear and practices, agricultural runoff, and sewage discharge (Frazier et al. 2007, Lutcavage et al. 1997). Hawksbills are typically associated with coral reefs, which are among the world’s most endangered marine ecosystems (Wilkinson 2000).

**Climate change**

Although climate change may expand foraging habitats into higher latitude waters and increasing ocean temperatures may also lead to reduced primary productivity and eventual food availability, climate change could reduce nesting habitat due to sea level rise, as well as affect egg development and nest success. Rising temperatures may increase feminization in all of the sea turtle species, and in some cases an ambient temperature increase by just 1°-2° C can potentially change hatching sex ratios to all or nearly all female in tropical and subtropical areas (Mrosovsky et al. 1984, Wibbels 2003, McMahon and Hays 2006, Hawkes et al. 2007a). Over time, this can reduce genetic diversity, or even population viability, if males become a small proportion of populations (Hulin et al. 2009). Sea surface temperatures on loggerhead foraging grounds has also been linked to the timing of nesting, with higher temperatures leading to earlier nesting (Mazaris et al. 2009, Schofield et al. 2009). Green sea turtles emerging from nests at cooler temperatures likely absorb more yolk that is converted to body tissue than do hatchlings from warmer nests (Ischer et al. 2009). However, warmer temperatures may also decrease the energy needs of a developing embryo (Reid et al. 2009).
**Marine debris**
Ingestion of marine debris can be a serious threat to sea turtles. When feeding, sea turtles can mistake debris (e.g., tar and plastic) for natural food items. Some types of marine debris may be directly or indirectly toxic, such as oil. Other types of marine debris, such as discarded or derelict fishing gear, may entangle and drown sea turtles. Plastic ingestion is very common in leatherbacks and can block gastrointestinal tracts leading to death (Mrosovsky et al. 2009).

**Poaching**
In the U.S., killing of nesting turtles is infrequent. However, on some beaches, human poaching of turtle nests and clandestine markets for eggs has been a problem (Ehrhart and Witherington 1987). Egg poaching is a more serious problem in Puerto Rico (Matos 1987).

**Contaminants**
In sea turtles, heavy metals, including arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, and zinc, have been found in a variety of tissues in levels that increase with turtle size (Godley et al. 1999, Fujihara et al. 2003, Storelli et al. 2008, Anan et al. 2001, Saeki et al. 2000, Gardner et al. 2006, Garcia-Fernandez et al. 2009, Barbieri 2009). Cadmium has been found in leatherbacks at the highest concentration compared to any other marine vertebrate (Gordon et al. 1998, Caurant et al. 1999). Newly emerged hatchlings have higher concentrations than are present when laid, suggesting that metals may be accumulated during incubation from surrounding sands (Sahoo et al. 1996). Arsenic has been found to be very high in green sea turtle eggs (van de Merwe et al. 2009).

Sea turtle tissues have been found to contain organochlorines, including chlorobiphenyl, chlordane, lindane, endrin, endosulfan, dieldrin, PFOS, PFOA, DDT, and PCB (Keller et al. 2004b, Keller et al. 2004a, Keller et al. 2005, Gardner et al. 2003, Storelli et al. 2007, McKenzie et al. 1999, Corsolini et al. 2000, Rybitski et al. 1995, Alava et al. 2006, Perugini et al. 2006, Monagas et al. 2008, Oros et al. 2009, Miao et al. 2001). PCB concentrations are reportedly equivalent to those in some marine mammals, with liver and adipose levels of at least one congener being exceptionally high (PCB 209: 500-530 ng/g wet weight; Oros et al. 2009, Davenport et al. 1990b). Levels of PCBs found in green sea turtle eggs are considered far higher than what is fit for human consumption (van de Merwe et al. 2009).

It appears that levels of organochlorines have the potential to suppress the immune system of loggerhead sea turtles and may affect metabolic regulation (Keller et al. 2006, Keller et al. 2004c, Oros et al. 2009). These contaminants could cause deficiencies in endocrine, developmental, and reproductive health (Storelli et al. 2007), and are known to depress immune function in loggerhead sea turtles (Keller et al. 2006). Females from sexual maturity through reproductive life should have lower levels of contaminants than males because contaminants are shared with progeny through egg formation. Exposure to sewage effluent may also result in green sea turtle eggs harboring antibiotic resistant strains of bacteria (Al-Bahry et al. 2009).
**Vessel strikes**

Propeller and collision injuries from boats and ships are common in sea turtles. From 1997 to 2005, 14.9% of all stranded loggerheads in the U.S. Atlantic and Gulf of Mexico were documented as having sustained some type of propeller or collision injuries although it is not known what proportion of these injuries were post or ante-mortem. The incidence of propeller wounds has risen from approximately 10% in the late 1980s to a record high of 20.5% in 2004 (NMFS, unpublished data).

**Military activities**

Vessel operations and ordnance detonations adversely affect listed species of sea turtles. U.S. Navy aerial bombing training in the ocean off the southeast U.S. coast involving drops of live ordnance (500 and 1,000-lb bombs) have been estimated to have injured or killed 84 loggerhead, 12 leatherback, and 12 green or Kemp’s ridley sea turtles, in combination (NMFS 1997). The Navy ship-shock trials for the USS Winston S. Churchill was conducted in the proposed Action Area, although the U.S. Navy employed a suite of measures that appeared to protect marine mammal and sea turtle from being exposed to shock waves produced by the underwater detonations associated with the trial (Clarke and Norman 2005).

In August and September 2008, the U.S. Navy conducted a ship shock trial on the Mesa Verde in waters east of Jacksonville, Florida, using High Blast Explosive (HBX-1) for the detonations (U.S. Navy 2008). NMFS’ biological opinion on the ship shock trial expected up to 36 sea turtles to be injured as a result of the ship shock trial and up to 1,727 turtles to be harassed as a result of their behavioral responses to the underwater detonations. The after action report for the ship shock trial could neither refute nor confirm these estimated number of animals that might have been harassed by the trials; however, surveys associated with the trial did not detect any dead or injured sea turtles during the shock trial event or during post-mitigation monitoring. In addition, no sea turtle stranding events have been attributed to the shock trial.

Military training activities that occur on coastal bases in the southeast U.S. have the potential to increase non-nesting emergences of nesting females, run over nesting females and emerging hatchlings, and destroy nests.

**Scientific research**

Sea turtles in the action area have been the subject of numerous scientific research activities as authorized by NMFS permits. Research activities for sea turtles range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, instrument attachment, blood and fecal sampling, biopsy sampling, lavage, and performing laparoscopy on intentionally captured turtles.

**International protection**

Sea turtles are migratory and therefore require participation between multiple countries to create an umbrella of protection and recovery techniques throughout their entire range. The Inter-American Convention for the Protection and Conservation of Sea Turtles
provides the legal framework for countries in the Americas and the Caribbean to take actions for the benefit of sea turtles. Regional Fishery Management Organizations (RFMO’s) such as the International Commission for the Conservation of Atlantic Tunas can create recommendations aimed at sea turtle bycatch under its managed fisheries; however, this is not an RFMO’s main function. The Convention on Trade in Endangered Species (CITES) regulates the trade of sea turtles; most, but not all nations have signed on to CITES and some nations have been found in violation of their signatory duties under CITES. The lack of a major international agreement to conserve and protect sea turtles is a major obstacle to sea turtle protection and recovery.

**Conservation and management**

NMFS has implemented a series of regulations aimed at reducing potential for incidental mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release gear requirements for the Atlantic Highly Migratory Species Fishery, Gulf of Mexico reef fish, and South Atlantic snapper-grouper fishery, and TED requirements for Southeast shrimp trawl fishery.

NMFS published a final rule on July 6, 2004, to implement management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality. In the Hawaii-based longline swordfish fishery which required vessels to switch from using a J-shaped hook with squid bait to a wider circle-shaped hook with fish bait has reduced capture rates of leatherback and loggerhead turtles significantly by 83% and 90% respectively (Gilman et al. 2007). There was also a highly significant reduction in the proportion of turtles that swallowed hooks (versus being hooked in the mouth or body or entangled) and a highly significant increase in the proportion of caught turtles that were released after removal of all terminal tackle, which could lead to the likelihood of turtles surviving the interaction (Read 2007).

NMFS has required the use of TEDs in southeast United States shrimp trawls since 1989 and in summer flounder trawls in the Mid-Atlantic area (south of Cape Charles, Virginia) since 1992. It has been estimated that TEDs exclude 97 percent of the sea turtles caught in such trawls (Cox et al. 2007). These regulations have been refined over the years to ensure that TEDs are properly installed and used where needed to minimize the impacts on sea turtles. On August 3, 2007, NMFS published a final rule required selected fishing vessels to carry observers on board to collect data on sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary (72 FR 43176).

NMFS published a final rule (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Those 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 turtles caught in
fishing or scientific research gear. There is also an extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico coasts that not only collect data on sea turtle mortality, but also rescue and rehabilitate any live stranded sea turtles that are encountered.

5. Effects of the Action

5.1 Analysis of effects of the proposed action

This section of a Biological Opinion assesses the direct and indirect effects of the proposed action on threatened and endangered species or critical habitat, together with the effects of other activities that are interrelated or interdependent (50 CFR § 402.02). Indirect effects are those that are caused later in time, but are still reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend upon the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR § 402.02).

5.2 Effects of the proposed action

The effects of the proposed action on listed sea turtles are entirely direct effects: capture and possible death in large and small mesh gillnets set in inshore waters of North Carolina. Indirect effects are either too speculative (possible adverse effect from removal of forage species by the fishery or possible beneficial effect by provision of dead bycatch as forage) to consider or are not consistent with the proposed action. Adverse impacts may also occur from lost gear or scarring of the seafloor, which may result in a loss of forage habitat. However, data are lacking on the level of impact that these activities may pose to sea turtles.

The proposed action is expected to result in both live captures (non-lethal take) and mortalities (lethal take) of sea turtles. Negative effects would occur when the operation of the inshore gillnet fishery results in incidental takes of sea turtles, including live captures where the turtle is released alive and mortalities resulting from the capture. Sea turtles are vulnerable to incidental capture in the North Carolina commercial inshore gillnet fishery because they are commonly found foraging in the same area and seasons where fishing occurs. The existing North Carolina proclamations, in place since 2010, were designed to minimize incidental capture of sea turtles in the commercial inshore gillnet fishery. These existing regulations have been incorporated within the conservation plan, with additional efforts to reduce incidental capture.

Incidental capture of sea turtles in the inshore gillnet fishery will have negative impacts on the individuals captured. An adverse effect on a single individual or a small group of animals does not always translate into an adverse effect on the population or species unless it results in reduced reproduction or survival of the individual(s) that causes an appreciable reduction in the likelihood of survival or recovery for the species. In order for the proposed action to have an adverse effect on a species, the take of individual animals by the fishery would first have to result in:
- mortality,
- serious injury that would lead to mortality, or
- disruption of essential behaviors such as feeding or migration, to a degree that the individual’s likelihood of successful reproduction or survival was substantially reduced.

The mortality or reduction in the individual’s likelihood of successful reproduction or survival would then have to result in a net reduction in the number of individuals of the species. The loss of the individual or its future offspring would not be offset by the addition, through birth or emigration, of other individuals into the population. That net loss to the species would have to be reasonably expected, directly or indirectly, to reduce the likelihood of both the survival and recovery of the listed species in the wild.

Since 2005, the majority (78.2%) of all observed sea turtle incidental captures in North Carolina inshore gillnets have been released alive. However, it is expected that some proportion of the sea turtles that are released alive after capture in a gillnet will succumb to post-release mortality due to the physiological effects of the capture, or they will experience a decreased ability to forage or migrate, which may make the more susceptible to re-capture within a short period of time. Sea turtles can dive for prolonged periods and to great depths voluntarily because of their low metabolic rates, efficient blood oxygen transport mechanisms, and moderate tolerance to hypoxia (Lutcavage and Lutz, 1997). Although sea turtles can stay submerged for 20-180 minutes during voluntary dives, forced submergence due to net entanglement can be lethal (Lutz and Bentley, 1985). Turtles caught in a net will struggle in attempts to escape and surface for air, and oxygen stores will be rapidly depleted. It has been found that the physiological damage incurred due to net entanglement may affect the turtle’s behavior and reduce its chances of survival post-release, and it has been suggested that a sea turtle’s recovery from lactic acid build up can take over 15 hours, depending on the length of time submerged and level of acidosis (Lutz and Dunbar-Cooper, 1987).

In November 2009, NMFS Northeast Regional Office (NER) convened a panel of experts to discuss and provide individual expert advice on the potential injury and post-release mortality of sea turtles from capture in fishing gear. Based on the expert panel advice, NER developed formal guidance on assessing bycatch injury and post-release mortality in multiple gear types. The guidance allows experts to use data collected from observed takes to evaluate the condition of turtles and assign a potential post-release mortality rate. The guidance document was not meant to provide a specific post-release mortality rate for each gear-type, but rather to provide guidelines for how post-release mortality could be analyzed after a take occurs for a particularly fishery. To apply the guidance experts would review the data collected by the observers on the body condition, new and existing injuries, as well as the activity level of the animal prior to release. At this time, NMFS is unable to apply the NMFS NER guidelines to the interactions that may occur in the North Carolina inshore gillnet fishery because the specific data required to apply the criteria are
not available, but anticipates the ability to apply the guidance to observed takes that occur in the future based on the data collected from observers.

Under the proposed action, the total estimated annual takes of Kemp’s ridley and green sea turtles, for the large mesh inshore gillnet fishery in Management Units B, D1, D2, and E is 642 estimated takes (Table 2.1, above). As explained above, for some species, areas, and gear, the data is not sufficient to derive an estimated take; thus, an “observed only” take will be used. Any observed take is acknowledged to be the absolute minimum as no estimation is made for interactions with unobserved fishery effort. Thus for the management units, species, and gear types with only observed takes, the actual take across the entire fishery is likely substantially higher than what is observed. The anticipated level of observed annual takes in large mesh gillnets in Management Units B, D1, D2, and E is 26 takes (Table 2.2, above). The anticipated level of observed takes in small mesh gillnets in Management Units B, D1, D2 and E is 44 takes (Table 2.3, above). Finally, the observed takes in Management Units A and C across all species and gear types is anticipated to be 8 turtles (Table 2.4, above).

In addition to the NMFS efforts to better characterize post-release mortality, a study was conducted in North Carolina waters to better determine the rate of survival for sea turtles that are captured in shallow-set gillnets and released alive (Snoddy and Southwood Williard, 2010). In this study, 14 live sea turtles captured in North Carolina gillnets were given health assessments, including biochemical analysis, and tagged with satellite transmitters prior to release. The primary goal of the study was to investigate the rate of post-release mortality of these turtles based on biochemical analysis and telemetry (Snoddy and Southwood Williard 2010). The study documented one confirmed mortality and three suspected mortalities from the sample size of 14 turtles. Based on the data they collected, Snoddy and Southwood Williard have estimated the post-release mortality of sea turtles releases from shallow-set gillnets as potentially ranging from 7.1% to 28.6%, although they caution that these rates are specific to soak times of 4 hours or less (Snoddy and Southwood Williard 2010).

Due to the small sample size, the results of this study may not be universally applicable to all inshore gillnets, but they do provide insight into the potential post-mortality rates for shallow-set gillnets in North Carolina. However, given that the study was conducted in North Carolina waters within the action area and fishery that will be covered under the ITP, we will evaluate the anticipated incidental take against the post-release mortality ranges described above for the purposes of this analysis.

When looking at the estimated annual takes of green and Kemp’s ridley sea turtles in the large mesh inshore gillnet fishery occurring in Management Units B, D1, D2, and E, the ITP would authorize 428 live sea turtle takes (330 greens, 98 Kemp’s ridley), and 214 dead sea turtle takes (165 green, 49 Kemp’s ridley). When applying the post-release mortality ranges to the 428 live captures, we might assume that of the 330 live green turtles captured, between 23.4 and 94.4 turtles might succumb to post-release mortality, and of the 98 live Kemp’s ridley sea turtles, between 6.9 and 28 turtles might succumb to post-release mortality.
When looking at the observed annual takes across all species and mesh size, a total of 78 sea turtles, either live or dead, are requested. A conservative estimate would assume that all 78 should be classified as dead in this analysis, since condition of the animal is not specified in the take request. However, if we assume that all 78 turtles were captured alive and released, we could apply the post-release ranges to those live takes. In this scenario, of the 78 live observed takes, between 5.5 and 22.3 turtles might succumb to post-release mortality from the injuries and physiological impacts resulting from the capture, although it is likely that some mix of live and dead turtles will be observed as takes.

The expected mortalities and any post-release mortalities resulting from the fishery may result in impacts to the recovery of sea turtle species in the wild. However, it is difficult to identify the impact of this individual fishery on sea turtle populations as there are a number of other stressors on the population that must be considered as cumulative effects. Additionally, due to the uncertainty of population estimates for each sea turtle species found in North Carolina’s waters, it is not possible to know the direct and specific impact of the North Carolina gillnet fishery on these sea turtle species.

The proposed ITP will include an Adaptive Management provision, through which NCDMF may make regulatory changes to the fishing season, as needed, to decrease sea turtle interactions. Regulatory changes might include increasing monitoring, increasing restrictions and closing specific areas to fishing. By including an adaptive management provision, the ITP will allow NCDMF to respond to new information about populations of protected resources, changes in knowledge about sea turtle life history characteristics, and enhancements to targeted fishery gear types in a way that protects sea turtles and other endangered or threatened species as well as preserving a fishing industry that relies on access to North Carolina’s estuarine waters. This process will ensure that the incidental take of sea turtles does not exceed the authorize level and will therefore ensure continued protection for endangered or threatened sea turtle populations and other protected species.

The issuance of the proposed ITP would not interfere with benthic productivity, predator-prey interactions, or other biodiversity or ecosystem functions. Issuance of the proposed ITP would not involve alteration of substrate, movement of water or air masses, or other interactions with physical features of ocean and coastal habitat. Thus, effects on biodiversity and habitat are not anticipated.

Lastly, the additional monitoring and reporting requirements incorporated into the ITP may benefit sea turtles, compared to the status quo, through improving our knowledge of sea turtle interactions in the North Carolina inshore gillnet fisheries. This monitoring will potentially provide a more robust understanding of how and when sea turtles interact with inshore gillnets, so that future mitigation measures can focus on those times and areas. The model used to predict interactions can be updated to more accurately account for sea turtle bycatch in the fishery, which will then inform future ITP development. Additionally, observer data may illustrate which life stages of the various species are
most commonly affected by gillnets, thereby providing some indication of the effects on population size and overall health of sea turtles found in North Carolina inshore waters. Based on this information NMFS and NCDMF can make more informed decisions to further reduce bycatch of sea turtle in gillnets.

5.3 Species’ response to effects of the proposed action

Sea turtle mortality as a result of the fishery operating under the ITP affect listed species through the obvious impact of the loss of individual turtles and also through the loss of the reproductive potential of each turtle lost to the population. Magnuson et al. (1990) estimates that the reproductive value of an adult loggerhead is 584 times that of an egg or hatchling, because so few eggs or hatchlings survive to maturity. Sea turtles are long-lived and delay sexual maturity for several decades. Loggerheads and green turtles may reach sexual maturity at 22 to 30 years of age, or 30 to 60 years of age, respectively. Females of each species lay approximately 100 to 130 eggs per clutch, and lay 3-4 clutches every 2 to 4 years. Thus, the death of adult or juvenile females could potentially preclude the production of thousands of eggs and hatchlings, though most of these would not survive to sexual maturity. NMFS is not aware of a disproportionate mortality of adult female turtles in the inshore gillnet fishery. Mortality of adult or large juvenile males would preclude their contribution to future generations, though it is difficult to quantify this impact given the minimal data on male sea turtles.

Kemp’s ridleys are estimated to reach sexual maturity at approximately 10 years of age. Females of each species lay approximately 100 eggs per clutch in 2-3 clutches every 2-3 years. Thus, the death of adult or juvenile females would preclude the production of thousands of hatchlings, though most of these would not survive to sexual maturity. NMFS is not aware of a disproportionate mortality of adult female Kemp’s ridleys in the inshore gillnet fishery. Mortality of adult or large juvenile males would preclude their contribution to future generations, though it is difficult to quantify this impact given the minimal data on male sea turtles.

The sea turtles killed in the inshore gillnet fishery, based on current information are primarily, and perhaps exclusively immature. Immature life stages of loggerheads have been identified by Crouse et al. (1987) as the stages to which overall population parameters are most sensitive to changes in mortality rates. In other words, increasing the survivorship of large juveniles by 50% will have a much stronger effect on population change than a 50% increase in survivorship of novice breeders. Mathematically, this makes sense, because there are many more juveniles than novice breeders, and juveniles spend longer in that stage and the effects of changes in survivorship can work exponentially for a longer period. This finding has been used as an argument to focus management efforts on reducing juvenile mortality, such as the implementation of this action, which will minimize the take of juvenile loggerheads in the North Carolina inshore gillnet fishery. The difficulty with applying this precept, however, is that the models look at proportionate mortality, which requires knowledge of the total population size, a knowledge that is lacking for loggerhead turtles. Still, an effort must be made to
evaluate actual turtle takes versus the total population size and to account for the numbers of turtles in each size class.

Effects on Loggerhead Turtles
For loggerhead sea turtles the existing data was not sufficient to derive estimated take levels. Therefore, only numbers of anticipated observed takes can be utilized. Although the observed takes can be either live or dead, we take the most conservative approach and assume that all of the takes are mortalities. Additionally, even though the permitted take for all species combined in Management Areas A and C is eight turtles, we take a conservative approach and analyze each species as if all eight takes would come from that species. Using this approach we get the following observed annual mortalities:

\[(12 \text{ for large-mesh gillnets in Management Areas B, D1, D2, and E}) + (12 \text{ for small-mesh gillnets in Management Areas B, D1, D2, and E}) + (8 \text{ for large and small-mesh gillnets in Management Areas A and C}) = 32.\]

As stated previously, we recognize that the actual take numbers would likely be substantially higher than the number of observed takes. Continuing to collect data on loggerhead takes in this fishery is an important aspect of the Conservation Plan and will potentially allow for estimating takes in the future. In the meantime, we focus on the status and trend of the species relative to the impacts of the fishery as it has operated in the past and will operate in the future.

Within the NW Atlantic DPS the two largest recovery units and the two recovery units most likely to be represented in North Carolina waters, the PFRU and the NRU, have both shown recent nesting increases and overall long-term increasing trends. Those two recovery units comprise the vast majority of the estimated total benthic population of 60,000 – 600,000, up to as high as under 2 million, for the DPS (NMFS-SEFSC 2009). While the nesting trends are influenced by many natural and anthropogenic factors, it is notable that they have been established during a period of time when the North Carolina inshore gillnet fishery experienced both higher effort and fewer management measures designed to protect sea turtles. Therefore, it is reasonable to conclude that impacts to loggerhead sea turtle populations from the fishery were higher than they will be under the proposed ITP.

It is also important to note that the current nesting trends have been established while the inshore gillnet fishery had greater effort and fewer management measures intended to protect sea turtles. Therefore, the impact from the inshore gillnet fishery on these species looking forward under the ITP can be expected to be less than they were in the past. Thus, based on the increases in nesting activity and the size of the DPS, the longevity of the North Carolina inshore gillnet fishery, the past effort of the fishery being greater than current effort, the conservation measures in place through the ITP to monitor take and the use of adaptive management to further reduce the impact to the species, NMFS anticipates that the loss of loggerheads detailed above would not have a significant effect on the distribution and reproduction of the population.
**Effects on Green Turtles**

The anticipated take of green turtles to be allowed in the ITP includes both estimated
takes and observed-only takes. It is expected that the observed takes would be an
absolute minimum for takes in those scenarios, with the actual numbers likely being
substantially higher. Estimated annual mortalities under the ITP will be up to 165
individuals. Applying the most conservative post-release mortality level from Snoddy
and Southward Williard (2010), the expected annual mortality level of individuals
released alive would be 95 turtles, for a total of 260 estimated annual mortalities.
Although the observed takes can be either live or dead, we take the most conservative
approach and assume that all of the takes are mortalities. Additionally, even though the
permitted take for all species combined in Management Areas A and C is eight turtles, we
take a conservative approach and analyze each species as if all eight takes would come
from that species. Using this approach we get the following annual mortalities:

\[
(260 \text{ estimated for large-mesh gillnets in Management Areas B, D1, and E}) + (6 \text{ observed}
\text{ for large-mesh gillnets in Management Area D2}) + (12 \text{ observed for small-mesh gillnets}
\text{ in Management Areas B, D1, D2, and E}) + (8 \text{ observed for large and small-mesh gillnets}
\text{ in Management Areas A and C}) = 286.
\]

The total population of green turtles is not known, but nesting activity in Florida and the
major Caribbean nesting beach at Tortuguero, Costa Rica, has increased over the long-
term. Significant increases in the populations of small juvenile green turtles have also
been detected in Florida. A long-term in-water monitoring study in the Indian River
Lagoon of Florida has tracked the population of juvenile green turtles in a foraging
environment and noted significant increases in catch-per-unit effort (more than doubling)
between the years 1983-85 and 1988-90. Catches of benthic immature turtles at the St.
Lucie Nuclear Power Plant intake canal have also been increasing since 1992 (Martin and
Ernst, 2000). Caution is warranted, however, given that greens may not reach sexual
maturity until 30 or even 60 years of age. Thus, a significant annual loss of juveniles
over a long time span could have a time lag effect on the breeding population. The
increase in juveniles recorded in Florida may be the effect of some historical event and
may not represent the current stresses to the population.

While the nesting trends are influenced by many natural and anthropogenic factors, it is
notable that they have been established during a period of time when the North Carolina
inshore gillnet fishery experienced both higher effort and fewer management measures
designed to protect sea turtles. Therefore, it is reasonable to conclude that impacts to
green sea turtle populations from the fishery were higher in the past than they will be
under the proposed ITP. Thus, based on the increases in nesting activity, the longevity of
the North Carolina inshore gillnet fishery, the past effort of the fishery being greater than
current effort, the conservation measures in place through the ITP to monitor take and the
use of adaptive management to further reduce the impact to the species, NMFS
anticipates that the loss of juvenile green turtles to the future breeding population over the
ITP duration would not have a significant effect on the distribution and reproduction of
the population.
**Effects on Kemp’s Ridley Turtles**

The anticipated take of Kemp’s ridleys to be allowed in the ITP includes both estimated takes and observed-only takes. It is expected that the observed takes would be an absolute minimum for takes in those scenarios, with the actual numbers likely being substantially higher. Estimated annual mortalities under the ITP will be up to 49 individuals. Applying the most conservative post-release mortality level from Snoddy and Southward Williard (2010), the expected annual mortality level of individuals released alive would be 28 turtles, for a total of 77 estimated annual mortalities. Although the observed takes can be either live or dead, we use the most conservative approach and assume that all of the takes are mortalities. Additionally, even though the permitted take for all species combined in Management Areas A and C is eight turtles, we take a conservative approach and analyze each species as if all eight takes would come from that species. Using this approach we get the following annual mortalities:

\[(77 \text{ estimated for large-mesh gillnets in Management Areas B, D1, D2, and E}) + (12 \text{ observed for small-mesh gillnets in Management Areas B, D1, D2, and E}) + (8 \text{ observed for large and small-mesh gillnets in Management Areas A and C}) = 97.\]

The total population of Kemp’s ridleys is not known, but nesting has been increasing significantly in the past several years (9-13%/year). The rapid increase in nesting indicates that juvenile survivorship is high and is providing an increasing number of new recruits to the adult population. Kemp’s ridleys reach sexual maturity at around 10 years of age. Benthic immature ridleys are estimated to be 2-9 years of age when they recruit to nearshore habitat. The majority of ridleys taken in this fishery are juveniles. Inshore gillnet fishing is a traditional fishery that has operated over a period encompassing several generations of the Kemp’s ridley.

While the nesting trends are influenced by many natural and anthropogenic factors, it is notable that they have been established during a period of time when the North Carolina inshore gillnet fishery experienced both higher effort and fewer management measures designed to protect sea turtles. Therefore, it is reasonable to conclude that impacts to Kemp’s ridley sea turtle populations from the fishery were higher in the past than they will be under the proposed ITP. Thus, based on the increases in nesting activity, the longevity of the North Carolina inshore gillnet fishery, the past effort of the fishery being greater than current effort, the conservation measures in place through the ITP to monitor take and the use of adaptive management to further reduce the impact to the species, NMFS anticipates that the loss of juvenile Kemp’s ridleys to the future breeding population over the ITP duration would not have a significant effect on the distribution and reproduction of the population.

**Effects on Leatherback and Hawksbill Turtles**

For leatherback and hawksbill sea turtles the existing data was not sufficient to derive estimated take levels. Therefore, only numbers of anticipated observed takes can be utilized. Although the observed takes can be either live or dead, we take the most conservative approach and assume that all of the takes are mortalities. Additionally, even though the ted take for all species combined in Management Areas A and C is eight
turtles, we take a conservative approach and analyze each species as if all eight takes would come from that species. Using this approach we get the following observed annual mortalities for each of the species:

\[ (4 \text{ for large-mesh gillnets in Management Areas B, D1, D2, and E}) + (4 \text{ for small-mesh gillnets in Management Areas B, D1, D2, and E}) + (8 \text{ for large and small-mesh gillnets in Management Areas A and C}) = 20. \]

As stated previously, we recognize that in most cases the actual take numbers would likely be substantially higher than the number of observed takes. However, leatherback and hawksbill sea turtles are only rare and occasional visitors to the inshore waters of North Carolina and it is highly unlikely that even the “observed only” levels of take allowed in the ITP would be reached for either species. The numbers are highly conservative and are elevated above that expected by virtue of there being multiple different management areas, each with having to be assigned the possibility of at least one take. Additionally, while the total of eight observed takes for Management Areas A and C apply to any combination of species, we have conservatively decided to analyze the impacts for each species accounting for all eight of the takes, however unlikely that scenario may be.

As detailed in Section 3, the population of leatherbacks in the Atlantic is generally thought to be increasing. The total Atlantic and Caribbean population size for hawksbills is not known, but overall nesting trends show a long-term decline. However, of the 10 nesting sites worldwide showing recent increases, nine are in the Caribbean.

It is notable that nesting trends for these species have been established during a period of time when the North Carolina inshore gillnet fishery experienced both higher effort and fewer management measures designed to protect sea turtles. Therefore, it is reasonable to conclude that impacts to leatherback and hawksbill sea turtle populations from the fishery, while always a very rare event, would have been higher in the past than they will be under the proposed ITP. Thus, based on the longevity of the North Carolina inshore gillnet fishery, the past effort of the fishery being greater than current efforts, the conservation measures in place through the ITP to monitor take and the use of adaptive management to further reduce the impact to the species, NMFS believes the additional annual loss of individuals from the North Carolina inshore gillnet fishery would not have a significant effect on the distribution and reproduction of the population.

6. Cumulative Effects

Cumulative effects include the effects of future State, Tribal, local, or private actions that are reasonably expected to occur in the action area considered in this biological opinion. 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.

Cumulative impacts from unrelated, non-Federal actions occurring in the northwest Atlantic may affect sea turtles and their habitats. Stranding data indicate sea turtles in
Atlantic waters die of various natural causes, including cold stunning, as well as human activities, such as incidental capture in state fisheries, ingestion of or entanglement in debris, vessel strikes, and degradation of nesting habitat. The cause of death of most sea turtles recovered by the stranding network is unknown. In waters of many Atlantic states, state-permitted coastal gillnetting may also affect listed sea turtles. Recreational hook-and-line fisheries have been known to lethally take sea turtles, including Kemp’s ridleys.

Fishing activities in state waters take several protected species. However, it is not clear to what extent state-water fisheries may affect listed species differently than the same fisheries operating in Federal waters. Further discussion on state water fisheries is contained in the Environmental Baseline section. As state-water fisheries begin to address illegal incidental capture through section 10(a)(1)(B) ITPs such as this ITP, protective measures to reduce or mitigate these takes will come into place. Ship strikes and small vessel traffic also kills or injures threatened and endangered sea turtles in the action area.

Sources of pollutants in Atlantic and Gulf coastal regions include atmospheric loading of pollutants such as PCBs, storm water runoff from coastal towns, cities and villages, runoff into rivers emptying into the bays, groundwater discharges and river input and runoff. Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects to larger embayments are unknown. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986), the impacts of many other anthropogenic toxins have not been investigated. Sea turtles nest primarily in the southeastern United States, and early life stages and breeding individuals of these species are likely to be impacted by pollution in these areas, as well as in the northeast. Necropsies of hatchlings and juveniles show that young turtles commonly consume plastics and tar balls (STSSN stranding data base).

For sea turtles, substantial impacts of human activities are still evident on nesting populations of all species, particularly those areas outside of U.S. control. This includes poaching of eggs from nests and using the turtles themselves for food or shell products.

Marine debris will likely persist in the action area in spite of MARPOL prohibitions. In Texas and Florida, approximately half of the stranded turtles examined have ingested marine debris (Plotkin and Amos 1990). Of 43 dead stranded green turtles examined by Bjorndal et al. (1994), 24 had ingested some sort of debris. Although fewer individuals are affected, entanglement in marine debris may contribute more frequently to the death of sea turtles.

Coastal runoff and river discharges carry large volumes of petrochemical and other contaminants from agricultural activities, cities and industries into the Gulf of Mexico. The coastal waters of the Gulf of Mexico have more sites with high contaminant concentrations than other areas of the coastal United States, due to the large number of waste discharge point sources. The species of turtles analyzed in this biological opinion
travel between nearshore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

Beachfront development, lighting and beach erosion control all are ongoing activities along the Gulf and Atlantic coasts. These activities potentially reduce or degrade sea turtle nesting habitats or interfere with hatchling movement to sea. Nocturnal human activities along nesting beaches may also discourage sea turtles 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 more stringent protective measures to protect hatchling sea turtles from the disorienting effects of beach lighting. Some of these measures are being drafted in response to ongoing lawsuits brought against the counties by concerned citizens who charged the counties with failing to uphold the ESA by allowing unregulated beach lighting which resulted in takes of hatchlings.

The combination of all these activities may cause effects to protected species that could prevent or slow a species' recovery. Designation of critical habitat, proactive approaches by other Federal agencies (i.e. the Army Corps of Engineers has limited dredging in southeastern channels to periods when turtles are not concentrated in the channels), participation by state, federal agencies, and the private sector in recovery plan implementation activities and the section 7 process all contribute to mitigating these potential cumulative effects.

7. Integration and Synthesis of Effects

This section provides an integration and synthesis of the information presented in the Status of the Species, Environmental Baseline, Cumulative Effects, and Effects of the Action sections of this Opinion. The intent of the following discussion is to provide a basis for determining the additive effects of the incidental take authorized in the ITP on loggerhead, leatherback, green, Kemp’s ridley, and hawksbill turtles, in light of their present and anticipated future status in the Gulf of Mexico, Caribbean and Atlantic Ocean.

The Status of the Species discussion describes how all listed sea turtle populations affected by the proposed action have been adversely affected by human-induced factors such as commercial fisheries, direct harvest of turtles, and modification or degradation of the turtle’s terrestrial and aquatic habitat. Effects occurring in terrestrial habitats have generally resulted in the loss of eggs or hatchling turtles, or nesting females, while those occurring in aquatic habitat have caused the mortality of juvenile, subadult and adult sea turtles through entanglement in fishing gear, ingestion of debris or pollution. While the loss of all these turtles, including eggs, has likely adversely affected the ability of all sea turtle populations considered in this Opinion to maintain or increase their numbers by limiting the number of individuals in these populations, the loss of females, results in reductions in future reproductive output.
Species with delayed maturity such as sea turtles are demographically vulnerable to increases in mortality, particularly of juveniles and subadults, those stages with higher reproductive value. As discussed in the Status of the Species, the age of sexual maturity of most species of sea turtles is currently unknown, although the sexual maturity of loggerhead turtles may be as high as 35 years, and green turtles may not reach maturity until 30-60 years. The potential for an egg to develop into a hatchling, into a juvenile, and finally into a sexually mature adult sea turtle varies among species, populations, and the degree of threats faced during each life stage. It is reasonable to assume that females killed prior to their first successful nesting will have contributed nothing to the overall maintenance or improvement of the species’ status, while females killed after their first successful nesting may have produced some juvenile turtles that survive to sexual maturity. Based on information provided in the Status of the Species section, it is currently unknown how past and present mortalities of individual sea turtles due to a variety of natural and human-induced factors have affected the ability of individual sea turtles to replace themselves, thereby maintaining population numbers. While it appears that most of the populations of listed sea turtle species in the Atlantic Ocean are stable or increasing, none have begun to approach the recovery goals. Additionally, the current cumulative impacts may be allowing for increases at this time, but it is unknown if full recovery could occur under the same cumulative impact scenario or if the populations would hit a threshold short of recovery in which their number are no longer able to increase.

Although a long-term, qualitative analysis of the anticipated effects to sea turtles due to the issuance of the ITP is complicated by a lack of information regarding the age-specific survivorship and age-specific fecundity of each of the sea turtle species considered in this Opinion, certain assumptions can be made using limited information from sea turtles in general and basic concepts of conservation biology. For example, an understanding of loggerhead turtle demography has been developed which provides a fundamental understanding of the relative reproductive values of various life history stages (Crouse et al., 1987, Magnuson et al. 1990), which can be broadly extended to other sea turtles. As described in the Status of the Species discussion, sea turtles face numerous natural and human-induced factors in both the marine and terrestrial phases of their life cycles. While the most vulnerable stages may be the early ones, the reproductive value of a turtle egg or hatchling is relatively low, and the sensitivity of population growth to a loss of an egg or hatchling also is low. This high mortality at early life stages has led to strong evolutionary pressures selecting for a high adult survival of sea turtles and a resulting ability for repeated reproduction. As a result, sea turtle populations under normal conditions are better adapted to withstanding losses at early life stages than their subadult and adult phases. Environmental factors which cause injury or mortality to individual juvenile, subadult, or adult sea turtles are more likely to have longer term, adverse effects on sea turtles at a population level than loss of eggs or hatchlings. At a much more basic level, if mortality rates exceed recruitment rates, populations will decline.

Of all the known factors identified in NMFS’ decision to list sea turtles as threatened or endangered, Status of the Species, the current Environmental Baseline, and anticipated Cumulative Effects described in this Opinion, by far the most significant sources of
injury or mortality of juvenile, subadult, and adult sea turtles are those associated with commercial fishing. Assuming observations of loggerhead demographics apply broadly to all sea turtles, these factors are acting on the life stages with the greatest reproductive value for the survival and recovery of sea turtle populations, large juveniles and subadults. The reproductive value of a mature sea turtle can be assumed to remain high for several years under normal conditions. Management measures have been undertaken to reduce the largest threats to these life stages in U.S. waters through the required use of TEDs in the shrimp and summer flounder trawl fisheries and through restrictions placed on the pelagic longline fishery.

The major nesting components in the western Atlantic for loggerheads (i.e. south Florida subpopulation), greens, and Kemp’s ridleys have all been showing long-term increases or stability. In the case of the relatively fast-maturing Kemp’s ridley, the TED requirements have been in place long enough to demonstrate a positive effect on the adult populations, through a greatly increased rate of population recovery. For the slow-maturing greens and loggerheads, the observed increases in nesters is more likely attributable to earlier protections afforded on the nesting beach, with more recent gains also attributable to fishery management measures, since changes in the mortality of juvenile animals will take longer to manifest as changes in the adult population. Since the true size of the juvenile components of these populations is unknown, caution is warranted in expecting these trends to continue.

For the purposes of this biological opinion, the effects of the North Carolina inshore gillnet fishery were considered over time given what is known about each species’ reproductive strategy. As stated earlier, all species taken in the inshore gillnet fishery are expected to be juveniles. Based on this analysis, the anticipated annual lethal take level for each of these species will not have a significant effect on the rate of recruitment into the breeding population (that is, the population’s ability to reproduce at a level sufficient enough to replace each individual taken). Specifically, we can make this determination because the green and the Kemp’s ridley populations are increasing, and the NWA DPS of loggerhead sea turtles is stable or increasing, despite continued historical interactions in the North Carolina inshore gillnet fishery, and the effects from other threats identified in the baseline and cumulative impact sections of this opinion. It is also important to note that the current trends have been established while the inshore gillnet fishery had greater effort and fewer management measures intended to protect sea turtles. Therefore, the impact from the inshore gillnet fishery on these species looking forward can be expected to be less than the past impact under which the species’ current trends were established. The low anticipated take of hawksbills and leatherbacks would not significantly affect the rate of recruitment to the breeding population throughout its range.

In conclusion, based upon our review of the best available information, including the effects of the proposed action, the status of the species, and cumulative effects, we believe that the proposed action is not likely to reduce appreciably the likelihood of the survival and recovery of loggerhead, green, hawksbill, Kemp’s ridley, or leatherback sea turtles in the wild by reducing their reproduction, numbers, or distribution.
8. Conclusion

We have analyzed the best available scientific and commercial data, the current status of the species, environmental baseline, effects of the proposed action, and cumulative effects to determine whether the proposed action is likely to jeopardize the continued existence of any sea turtle species. In doing so, the analysis focused on the impacts and population response of sea turtles in the Atlantic Ocean. However, the impact of the effects of the proposed action on the Atlantic populations of green, Kemp’s ridley, leatherback and hawksbill turtles is directly linked to the global populations of those species, and the final jeopardy analysis is for the global populations as listed in the ESA. The NW Atlantic loggerhead turtles that have been listed as a DPS, and, therefore, the final jeopardy analysis for loggerheads is based on the DPS listing, as this is the entity listed in the ESA.

Based upon the analyses described above, it is our opinion that issuance of the ITP and the operation of the North Carolina inshore gillnet fisheries under NCDMF management and as described in the conservation plan:

- is not likely to jeopardize the continued existence of loggerhead, green, hawksbill, Kemp’s ridley, or leatherback sea turtles.

Critical habitat has not been designated for these species in the action area; therefore, the destruction or adverse modification of critical habitat will not occur.

9. Incidental Take Statement

Section 9 of the ESA and protective regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the RPAs and terms and conditions of the ITS. Consequently, takes that occur in the fishery while not fishing in compliance with the regulatory requirements established by the FMP are not incidental to an otherwise lawful activity and constitute unlawful take under the ESA.

Section 7(b)(4)(c) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of endangered marine mammals is provided and no take is authorized. Nevertheless, F/SER2 must immediately notify (within 24 hours, if
communication is possible) NMFS’s Office of Protected Resources should a take of a listed marine mammal occur.

9.1 Extent of take anticipated

The proposed NCDMF inshore gillnet fishery ITP application and conservation plan and its associated documents, this biological opinion, and the section 10(a)(1)(B) ITP itself, clearly identify anticipated impacts to affected species likely to result from the proposed taking and measures that are necessary and appropriate to minimize those impacts. All conservation measures described in the ITP application and conservation plan, the implementing agreement between NMFS and NCDMF, together with the terms and conditions described in the Section 10(a)(1)(B) ITP issued with respect to the application, are hereby incorporated by reference as reasonable and prudent measures and terms and conditions within this Incidental Take statement pursuant to 50 CFR § 402.14(i). Such terms and conditions are non-discretionary and must be undertaken for the exemptions under section 10(a)(1)(B) and section 7(o)(2) of the ESA to apply. If the permittee fails to adhere to these terms and conditions, the protective coverage of the section 10(a)(1)(B) ITP and section 7(o)(2) may lapse. The amount or extent of incidental take anticipated under the ITP application, associated reporting requirements, and provisions for disposition of dead or injured animals are as described in the Effects of the Action section of this biological opinion, the application, and its accompanying section 10(a)(1)(B) ITP. For clarity, the levels of take are summarized below. Take levels are specified by species, management area, and disposition (live or dead) for estimated take levels to be calculated using NCDMF’s take model. For the cases where estimates cannot be calculated, observed-only take limits are established by species and management area with no allowance of differentiation between live or dead take. The estimated take numbers used in the ITS represent a worst-case scenario. It is highly unlikely that the total authorized take level will be approached in a season or a year because the NCDMF will use adaptive management to close a given Management Unit for the remainder of that season if takes approach the authorized level for any one of the five species not when the authorized level is reached for all of the species.

Table 9.1 Anticipated annual **estimated** takes in **large mesh** (≥4 inch stretched mesh) gillnets.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Estimated Take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>D1</td>
</tr>
<tr>
<td>Green</td>
<td>225</td>
<td>112</td>
</tr>
<tr>
<td>Kemp’s ridley</td>
<td>53</td>
<td>26</td>
</tr>
<tr>
<td>Total Estimated</td>
<td>278</td>
<td>138</td>
</tr>
</tbody>
</table>
Table 9.2 Anticipated annual **observed** (not estimated) takes in **large mesh** (≥4 inch stretched mesh) gillnets.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Observed Take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>D1</td>
</tr>
<tr>
<td></td>
<td>Observed (live/dead)</td>
<td>Observed (live/dead)</td>
</tr>
<tr>
<td>Green</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hawskbill</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Leatherback</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Observed Take</strong></td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

Table 9.3 Anticipated annual **observed** (not estimated) takes in **small mesh** (<4 inch stretched mesh) gillnets.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Observed Take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>D1</td>
</tr>
<tr>
<td></td>
<td>Observed (live/dead)</td>
<td>Observed (live/dead)</td>
</tr>
<tr>
<td>Green</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Hawskbill</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kemp’s ridley</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Leatherback</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total Observed Take</strong></td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 9.4 Anticipated annual **observed** (not estimated) takes in **large mesh** (≥4 inch stretched mesh) and **small mesh** (<4 inch stretched mesh) gillnets **combined**.

<table>
<thead>
<tr>
<th>Species</th>
<th>Area</th>
<th>Total Observed Take</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>A</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Observed (live/dead)</td>
<td>Observed (live/dead)</td>
</tr>
<tr>
<td>Green, Hawskbill, Kemp’s ridley, Leatherback, Loggerhead</td>
<td>4 turtles of any species</td>
<td>4 turtles of any species</td>
</tr>
<tr>
<td><strong>Total Observed Take</strong></td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>
Table 9.4 Total annual anticipated take (estimated and observed) by species and condition.

<table>
<thead>
<tr>
<th></th>
<th>Total Takes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Observed</td>
</tr>
<tr>
<td></td>
<td>live/dead</td>
</tr>
<tr>
<td>Green</td>
<td>18</td>
</tr>
<tr>
<td>Hawksbill</td>
<td>8</td>
</tr>
<tr>
<td>Kemp’s ridley</td>
<td>12</td>
</tr>
<tr>
<td>Leatherback</td>
<td>8</td>
</tr>
<tr>
<td>Loggerhead</td>
<td>24</td>
</tr>
<tr>
<td>Any Species</td>
<td>8</td>
</tr>
<tr>
<td>Total Annual Take</td>
<td>78</td>
</tr>
</tbody>
</table>

### 9.2 Effect of the take

The effects of the North Carolina inshore gillnet fishery were considered over time given what is known about each species’ reproductive strategy. All species taken in the inshore gillnet fishery are expected to be juveniles. The anticipated annual lethal take level for each of these species will not have a significant effect on the rate of recruitment into the breeding population (that is, the population’s ability to reproduce at a level sufficient enough to replace each individual taken). Specifically, we can make this determination because the green and the Kemp’s ridley populations are increasing, and the NWA DPS of loggerhead sea turtles is stable or increasing, despite continued interactions in the fishery and the effects from other threats identified in the baseline and cumulative impact sections of this opinion. It is also important to note that the current trends have been established while the inshore gillnet fishery had greater effort and fewer management measures intended to protect sea turtles. Therefore, the impact from the inshore gillnet fishery on these species looking forward can be expected to be less than the past impact under which the species’ current trends were established. The low anticipated take of hawksbills and leatherbacks would not significantly affect the rate of recruitment to the breeding population throughout its range.

In conclusion NMFS has determined that this level of anticipated take is not likely to reduce appreciably the likelihood of the survival and recovery of loggerhead, green, hawksbill, Kemp’s ridley, or leatherback sea turtles in the wild by reducing their reproduction, numbers, or distribution.

### 9.3 Reasonable and Prudent Measures

The reasonable and prudent measures (RPMs), with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed activities. If, during the course of the action, the level of incidental take for any one of the turtle species is exceeded, in addition to ending the authorization for incidental take specified in the ITP, such incidental take represents new
The following Reasonable and Prudent Measure is required under the terms of this Opinion:

NCDMF must abide by the conditions set forth in the ESA ITP to be granted by NMFS, along with the associated Conservation Plan and the Implementing Agreement between NCDMF and NMFS. The conditions of this ITP are also set forth in the Terms and Conditions below.

9.4 Terms and Conditions

To be exempt from take prohibitions established by Section 9 of the ESA, NMFS must comply with the following terms and conditions, which implement the RPM described above. These terms and conditions are non-discretionary. The Terms and Conditions include following the requirements of the ITP, conservation plan, and the implementing agreement, all incorporated by reference as part of this Opinion. Among those requirements are the responsibilities listed below. Any requirements in those three documents not specifically listed below must still be adhered to as a Term and Condition of this Opinion.

A. Conditions to Monitor and Minimize Impacts to Listed Species

1. Management Measures. The following minimum management measures identified in the Conservation Plan must be maintained:

   (1) Restricted soak times for large mesh gillnets from one hour before sunset on Monday through Thursday and one hour after sunrise from Tuesday through Friday (i.e., fishing is prohibited from one hour after sunrise on Friday through one hour before sunset on Monday);
   (2) Restrictions on the maximum net length per large mesh fishing operation (i.e., 2,000 yards (1.83 km, 6,000 ft.) per operation except south of the North Carolina Highway 58 bridge and Management Area D2 where 1,000 yards (0.91 km, 3,000 ft.) is maximum;
   (3) Restrictions on large mesh net-shot lengths to 100 yards (91.44 m, 300 ft.) with a 25 yard (22.86 m, 75 ft.) separation between each net-shot;
   (4) Requirement for large mesh nets to be low profile (e.g., maximum of 15 meshes in depth, tie-downs prohibited, floats or corks prohibited along float lines north of the North Carolina Highway 58 bridge);
   (5) Closure of Management Area D1 to unattended large mesh gillnets from May 8 – October 14 annually;
   (6) Prohibition on large mesh gillnets in the deep water portions of the PSGNRA and Oregon, Hatteras, and Ocracoke inlets from September 1 – December 15; and
   (7) Adaptive fishery management measures and restrictions through state
proclamation authority (e.g., gear and/or area restrictions, attendance requirements, increased observer coverage and/or enforcement).

(8) Continuation of North Carolina’s regulations for small mesh gillnet attendance requirements, effective on the date the ITP is issued.

2. Enforcement. Adequate enforcement measures must be employed to ensure compliance by fishermen with all conditions of the ITP. Enforcement presence must be conducted on a variable schedule to prevent anticipation of enforcement presence at any given time.

3. Monitoring Requirements. NCDMF will maintain a monitoring program that consists of a combination of onboard and alternate platform observers, trip ticket program, and marine patrol officer activities (when needed). NCDMF will monitor six primary management units in inshore waters as described in the conservation plan.

   a) Large mesh gillnets – NCDMF will monitor at least 7% (with a goal of 10%) of large mesh (≥4.0 ISM) gillnet trips in each area during each of 3 seasons (i.e., spring, summer, and fall) as defined in the conservation plan.

   b) Small mesh gillnets – NCDMF will monitor at least 1% (with a goal of 2%) of small mesh (<4.0 ISM) gillnet trips in each area during each of 3 seasons (i.e., spring, summer, fall) as defined in the conservation plan.

NCDMF will use data collected through the Observer Program using the methodologies outlined in the conservation plan to conduct annual analyses to better understand bycatch estimates for Kemp’s ridley and green turtles. Weekly and seasonal estimated sea turtle takes will be calculated by NCDMF to ensure authorized estimated and/or observed take levels are not being approached. Separate estimates must be made for live and dead bycaught turtles. For purposes of these estimates, any observed, captured turtles that are released alive, uninjured, and in a vigorous condition will be used to produce the “live” estimates. Observed, captured turtles in any other condition will be used for the “dead” estimates. The cumulative total of the individual weekly estimates must also be calculated by NCDMF to determine whether the maximum authorized take levels in Section III are being approached. NCDMF shall inform NMFS promptly if the authorized take levels are being approached.

NCDMF will monitor data collected and identify, in a timely manner, whether unusually high sea turtle bycatch occurred within a management unit or subunit, such that NCDMF determines that closure and evaluation is necessary to (1) avoid approaching a take limit, or (2) provide adequate protection for sea turtles by implementing additional mitigation measures, or (3) to allow sea turtles to complete a seasonal migration and minimize interactions. NCDMF will confer with the NMFS on the identification of hotspots.

4. Reporting Requirements.

   a) Take Reports: NCDMF will report all incidental sea turtle takes to NMFS Office
of Protected Resources (OPR) via email within 24 hours of their occurrence in any season of the year (spring, summer, fall and winter), whether documented by an observer or reported by a fisherman. Reports of incidental take should include the date of the take, the condition of the turtle, the species (if known), photographs, and any other pertinent details of the circumstances of the taking (e.g., location, gear description, etc.). NCDMF will also provide copies of all take reports to the NC Sea Turtle Stranding and Salvage Network (STSSN) within 24 hours of the take.

b) Weekly Progress Reports: For those weeks in which sea turtle interactions are documented, a weekly report must be submitted to the NMFS OPR by Friday of the following week. The weekly reports must include the weekly take estimates and cumulative totals, including: observed takes with species, location, condition, and photos; and the total number of observed trips in that area.

c) Seasonal Progress Reports: Progress reports must be submitted to the NMFS OPR within 30 days after the end of the spring, summer, and fall seasons (i.e., June 30, September 30, and December 31). The reports must include:
   i. A summary of the weekly reporting information previously submitted;
   ii. Descriptions of any additional management measures taken by NCDMF;
   iii. One or more maps or graphical displays illustrating the geographic distribution of all observed large and small mesh gillnet trips and the locations of all observed incidental takes of sea turtles;
   iv. The number of law enforcement contacts made with gillnet vessels and the nature of these contacts;
   v. Any violations detected by NCDMF of the proclamations implementing the requirements of this ITP, and the status of all resulting enforcement actions; and
   vi. A description of any adaptive management actions taken.

d) Annual Reports: NCDMF will prepare annual written reports for each year during which the Plan is in effect. A year is defined as beginning September 1 and ending the following August 31 (e.g., September 1, 2013 through August 31, 2014). NCDMF will submit annual reports for September 1 through August 31 to NMFS by the following January 31 (i.e., 5 months after the year ends). A summary of the key contents of each annual report is provided below:
   i. Actual and estimated incidental takes (including mortality) and the level of uncertainty of the estimates (e.g., confidence intervals) of Covered Species by management units as described in the conservation plan;
   ii. Size composition, disposition (alive/dead), location, and dates of incidental take of Covered Species recorded during monitoring program as described in the conservation plan and conservation plan Appendix;
   iii. One or more maps or graphical representations illustrating the geographic distribution of all observed large and small mesh gillnet hauls and the locations of all observed incidental sea turtle takes; and
iv. A description of the mitigation activities, adaptive management actions, and enforcement activities conducted.

5. Adaptive Management. NCDMF shall use a variety of adaptive fishery management measures and restrictions through their state proclamation authority to reduce sea turtle mortality and prohibit fishing in management units where incidental take thresholds are approaching authorized take levels. NCDMF will use proclamation authority to implement management measures necessary to reduce sea turtle takes. Proclamation authority allows NCDMF to implement timely responses (i.e., within 48 hours) that may provide increased protection of sea turtles. For example, appropriate restrictions may include gear or area restrictions, attendance requirements, modifications in observer coverage, increased enforcement, or a combination of these and other restrictions. The need for additional management measures or better direction of resources will be determined by NCDMF in consultation with NMFS OPR. NCDMF and NMFS consultations must include analyses of relevant data, including but not limited to at-sea monitoring, NC Trip Ticket Program, fish house checks, enforcement, and strandings. Consultations will be among staff from NCDMF and NMFS OPR. If there is a disagreement about any changes to management not specified within the permit, NMFS will convene, at NCDMF’s request, a consultation with the Assistant Administrator for Fisheries for resolution final decision on the disagreement.

Potential adaptive management restrictions may include gear or area restrictions, attendance requirements, modifications in observer coverage, increased enforcement, or a combination of these and other restrictions. The NCDMF will consult regularly with the NMFS OPR to ensure that monitoring and management programs maintain the flexibility for the NCDMF to monitor, anticipate, respond, and implement needed action. As with all measures in the Permit, the adaptive management measures will be evaluated on an annual basis to determine which, if any, management changes were effective.

Another key component of an adaptive monitoring program is the identification of areas of high potential for bycatch of protected species in gillnet fisheries through observed interactions and on the water sightings of sea turtles by the NCDMF observers, biological staff, the NC STSSN, NC Marine Patrol, reports from commercial and recreational fishermen, and the general public. These areas will be referred to as “hotspots” and will provide managers the opportunity to address bycatch concerns through timely implementation of conservation measures such as increased observer and Marine Patrol coverage, additional gear restrictions, and temporary and/or seasonal closures. A “hotspot” will be defined as any area where sea turtle observations and/or sightings are above the previous two-year average for the season and Management Unit and has the potential for increased interactions.

6. Mitigation Activities. NCDMF must ensure (i.e., issue a proclamation) that all commercial and recreational fishermen report all incidental captures of sea turtle to NCDMF and require that fishermen follow the requirements listed below for the safe handling, resuscitation, and disposition of any incidentally captured turtles. Human safety is paramount and will supersede these requirements as necessary.
Sea Turtle Handling and Resuscitation Requirements

a) Fishermen must bring captured turtles aboard immediately upon detecting them in their net and remove them from the net with all due care to avoid further injury to the turtle.
b) Resuscitation must be attempted on sea turtles that are inactive or comatose by placing the turtle in its normal position on its breastplate (plastron) and elevating its hindquarters several inches 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. Sea turtles being resuscitated must be kept moist and protected from excessive heat and cold.
c) Sea turtles that are actively moving or begin actively moving following resuscitation must be held aboard the vessel in an open container (e.g. a fish box) that allows the turtle to rest normally on its breastplate, while restricting its movement and preventing the possibility of injury from any fishing operations. Turtles that are too large to fit inside a holding container must be otherwise confined to an area of the vessel that is free of sharp objects or harmful materials and where chance of injury from fishing operations is minimal.
d) For all comatose or revived turtles, the NC STSSN must be contacted immediately so the animal can be transferred to rehabilitation for evaluation.

Incidentally Taken Sea Turtle Specimens

a) Release of active and uninjured sea turtles: Live uninjured turtles should be released immediately following capture. The release location should be far enough from the nets to avoid immediate recapture but within the vicinity of where they were captured. Turtles must be released over the stern or side of the boat with the engine out of gear in an area where they are unlikely to be recaptured by other nets or injured by vessels.

b) For sea turtles that are injured, lethargic, or dead, fishermen must immediately contact the NCDMF Marine Patrol and transfer the turtle to an NCDMF patrol vessel. If no NCDMF patrol vessel is in the vicinity, fishermen must transport the turtle immediately to the nearest U.S. Coast Guard Station and contact the NC STSSN immediately to arrange for transfer of the turtle to a rehabilitation facility.

Tagging of Incidentally Taken Sea Turtle Specimens

Observers must tag all live, active turtles prior to release with two flipper tags and one passive integrated transponder (PIT) tag, provided the turtle meets the minimum size criteria for tagging. Tagging procedures must be coordinated with and tag data must be submitted to the Cooperative Marine Turtle Tagging Program of the University of Florida. NCDMF must coordinate with NMFS on observer training programs. NMFS will provide, based on available staff, training for observers on handling and tagging sea turtles.
Stranding Monitoring

Independent from this Permit, the NC STSSN, operated by the North Carolina Wildlife Resources Commission (NCWRC), monitors the strandings of sea turtles in inshore areas. NCDMF must provide copies of all take reports to the NC STSSN within 24 hours of the take, to facilitate information exchange necessary to compare stranding and incidental take locations for analysis, such as identifying “hotspots”.

7. Interactions with Manatees. U.S. Fish and Wildlife Service (USFWS) Guidelines to Reduce the Impact to Manatees if Encountered by Fisherman. NCDMF must issue a proclamation specifying the guidelines fishermen must follow in the event that a manatee is encountered.

a. The applicant will inform all fishermen associated with the fishery that manatees may be present in the area and the need to avoid any harm to these endangered mammals. The applicant will ensure that all fishermen know the general appearance of the species and their habit of moving about completely or partially submerged in shallow water. All fishermen will be informed that they are responsible for observing water-related activities for the presence of manatees.

b. The applicant will advise all fishermen that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Act and the Marine Mammal Protection Act.

c. If a manatee is seen within 300 ft of the active vessel movement, all appropriate precautions shall be implemented to ensure protection of the manatee. The precautions shall include the operation of all moving vessels no closer than 50 ft of a manatee. Operation of any vessels closer than 50 ft to a manatee shall necessitate immediately placing any motors in neutral or shutting them off. Activities will not resume until the manatee has departed the fishing area on its own volition. Manatees should not be herded away or harassed into leaving.

d. Fishermen will monitor and tend nets for manatees at the same time they do so for sea turtles. For help with an entangled, injured, or stranded manatee, fishermen should contact:

Rachel Lo Piccolo
NOAA, Beaufort Lab
101 Pivers Island Road
Beaufort, NC 28516
252-728-8762 (office)
252-444-8064 (pager)

In the event an entangled manatee is encountered fishermen should take immediate actions in a manner that best minimizes stress or injury to the animal.
but is sufficient to free it entirely while maintaining fisherman safety. The above person should then be contacted as soon as possible.

e. Any boat collision or fishing gear interaction with and/or injury to a manatee will be reported immediately. The report must be made to USFWS and NCWRC, and fishing should be postponed until cause of injury or mortality can be determined and a revised fishing and or monitoring plan is produced and approved. The addresses for USFWS and NCWRC are:

U.S. Fish and Wildlife Service
P.O. Box 33726
Raleigh, NC 27636-3726
919-856-4520 extension 16

North Carolina Wildlife Resources
183 Paul Drive
Trenton, NC 28585
252-448-1546

f. A sign should be posted in all fish houses associated with the fisheries where it is clearly visible, and will be distributed, as appropriate, to vessel operators to post in vessels. The sign should state:

CAUTION: The endangered manatee may occur in these waters during the warmer months, primarily from June through October. Idle speed is required if operating this vessel in shallow water during these months. All motors must be shut down or placed in neutral if a manatee comes within 50 ft of the fishing vessel. A collision with and/or injury to a manatee must be reported immediately to the USFWS and NCWRC.

g. All vessels associated with the fishing activities will operate at “no wake/idle” speeds at all times while in water where the draft of the vessel provides less than four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

10. Additional Restrictions and Closure of the Fishery. If estimated or observed sea turtle interactions or mortalities exceed thresholds specified in the ITP, NCDMF must immediately close the appropriate area to fishing with gillnets. NCDMF must then analyze the available observer data and consult with NMFS to determine the appropriate next steps.
10. Reinitiation Statement

This concludes formal consultation on NMFS’ proposed issuance of a section 10(a)(1)(B) ITP to North Carolina Division of Marine Fisheries. As provided in 50 CFR § 402.16, reinitiation of 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 this action that may affect listed species or critical habitat in a manner or to an extent not previously considered herein, including but not limited to information, data, or analysis indicating significant adverse impacts upon listed species or marine mammals related to low frequency sound transmissions or the initiation of a shutdown, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of take has been exceeded, NMFS must immediately request reinitiation of formal consultation.
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