ENDANGERED SPECIES ACT SECTION 7 CONSULTATION
BIOLOGICAL OPINION

Agency: Nuclear Regulatory Commission

Activity: **Reinitiation** – Continued Operation of Oyster Creek Nuclear Generating Station pursuant to a License issued by the NRC in April 2009
F/NER/2010/01855

Conducted by: NOAA's National Marine Fisheries Service
Northeast Regional Office

Date Issued: Nov 21, 2011

Approved by: [signature]

INTRODUCTION
This constitutes NOAA's National Marine Fisheries Service's (NMFS) biological opinion (Opinion) issued in accordance with section 7 of the Endangered Species Act of 1973, as amended, on the effects of the continued operation of the Oyster Creek Nuclear Generating Station (OCNGS) pursuant to a license issued by the Nuclear Regulatory Commission (NRC) in 2009 in accordance with the Atomic Energy Act of 1954 as amended (68 Stat. 919) and Title II of the Energy Reorganization Act of 1974 (88 Stat. 1242).

This Opinion is based on information provided in NRC's June 2006 Final Generic Environmental Impact Statement, a March 29, 2005 Biological Assessment (BA), records from previous section 7 consultations on the operation of this facility and correspondence with NRC staff, AmerGen Energy Company, Exelon, and other sources of information. A complete administrative record of this consultation will be kept on file at the NMFS Northeast Regional Office, Gloucester, Massachusetts.

BACKGROUND AND CONSULTATION HISTORY
The OCNGS began commercial operation in 1969. No observed takes of endangered or threatened species occurred at the OCNGS prior to 1992. However, between June 1992 and July 1994, 9 sea turtle impingements occurred at the OCNGS intake trash bars, including 5 loggerheads (4 individuals, 1 recapture), and 4 Kemp's ridleys (see Figures 1 and 2 and complete information in Appendix 1). In a letter dated November 2, 1993, NMFS stated that formal consultation on the operation of the OCNGS was necessary due to takes of threatened and endangered sea turtles. In a letter dated November 19, 1993, the NRC requested formal consultation. A BA was prepared by the OCNGS, reviewed and submitted by the NRC, and received by NMFS on January 25, 1995.

A Biological Opinion (Opinion) on the effects of the operation of OCNGS on loggerhead, green, and Kemp's ridley sea turtles was signed on September 21, 1995. This Opinion concluded that the continued operation of OCNGS may adversely affect listed turtles, but was not likely to jeopardize the continued existence of any sea turtle species. The accompanying Incidental Take Statement (ITS) exempted the annual take of 10 loggerhead (no more than 3 lethal), 3 Kemp's ridley (no more than 1 lethal), and 2 green (no more than 1 lethal) sea turtles. The incidental take exemption extended for a period of 5 years from the date of the Opinion (i.e., to September 21, 2000).

Between 1995 and 2000, there were nine takes of sea turtles associated at OCNGS. Although no sea turtles were captured in 1995 or 1996, the level of incidental take exempted in the 1995 Opinion was met in 1997, 1999, and 2000.

On August 3, 2000, NMFS was copied on a letter from the Acting Site Director of the OCNGS, Sander Levin, to the NRC, requesting the renewal of the Biological Opinion/Incidental Take Statement and submitting an updated BA. On September 18, 2000, NRC requested reinitiation of formal consultation on the effects of the continued operation of the OCNGS on sea turtles and submitted a revised BA. On January 23, 2001, the NRC submitted supplemental information and clarification on the BA as requested by NMFS. NRC also identified areas where data were lacking or unavailable. Consultation was completed with the issuance of an Opinion dated July 18, 2001. The accompanying ITS exempted the annual take of 5 loggerheads (no more than 3 lethal), 4 Kemp's ridley (no more than 3 lethal), and 2 green (no more than 1 lethal) sea turtles. A revised ITS was issued on August 29, 2001 in response to concerns raised by the AmerGen Energy Company[1] in regards to some requirements in the terms and conditions; however, no changes were made to the numbers of exempted sea turtle takes.

On August 7, 2004, the OCNGS recorded its fifth incidental take of a Kemp's ridley sea turtle since the beginning of that year, exceeding the level of take exempted in the 2001 ITS. This incidental take was followed by 3 more takes of Kemp's ridley sea turtles on September 11, September 12, and September 23, 2004 respectively. In a letter dated August 26, 2004, NRC requested reinitiation of formal section 7 consultation for the continued operation of OCNGS. On April 28, 2005 NMFS received a BA, dated March 29, 2005 from the NRC. Section 7 consultation concluded with the issuance of an Opinion dated September 22, 2005. This Opinion analyzed the effect of the continued operation of the OCNGS through the expiration of the current NRC license (April 2009). In this Opinion, NMFS concluded that the continued operation of the OCGNS was likely to adversely affect but not likely to jeopardize the continued existence of loggerhead, Kemp's ridley or green sea turtles. The ITS accompanying the 2005 Opinion exempted the annual take of 2 loggerheads (1 lethal), 8 Kemp's ridleys (4 lethal), and 1 green (alive or dead) annually as a result of the operation of the OCNGS.

1 The OCNGS was previously owned and operated by the AmerGen Company. The facility is currently owned and operated by Exelon.

In a letter dated June 9, 2006, NRC requested the initiation of Section 7 consultation on the effects of the operation of the OCNGS under a proposed renewed NRC license which would authorize operation of OCNGS for an additional 20 years. Consultation was concluded with the issuance of an Opinion on November 21, 2006. In this Opinion, NMFS concluded that the operation of the OCGNS pursuant to the license proposed to be issued by NRC in April 2009, was likely to adversely affect but not likely to jeopardize the continued existence of loggerhead, Kemp's ridley or green sea turtles. The ITS exempts the annual take of up to 8 sea turtles at the facility each year. NMFS anticipated that of these 8 sea turtles, no more than 3 of these turtles are likely to be loggerheads and no more than 1 of these sea turtles are likely to be a green sea turtle. NMFS anticipated that up to 3 of the 8 sea turtles may be dead; of the dead sea turtles, no more than 1 is likely to be a green sea turtle and no more than 1 is likely to be a loggerhead. The November 2006 Opinion became effective on April 9, 2009, the date that the new NRC license was issued.

On September 25, 2009, the level of exempted take (8 sea turtles total) was exceeded with the capture of a live Kemp's ridley sea turtle. Shortly after, NRC and NMFS discussed the need to reinitiate the consultation. Two additional live Kemp's ridley sea turtles were captured at the facility in 2009. In April 2010, consultation was reinitiated. During the summer and fall of 2010 as the consultation was being written, eight sea turtles were captured at the facility. The capture of a second green sea turtle during 2010 (October 11, 2010) and a third on October 30, 2010, represented new information as there had never been more than one green sea turtle captured at OCNGS in a given year. Upon mutual agreement, the consultation period was extended to allow NMFS to consider this new information in the development of the pending Opinion. In 2011, a total of 8 sea turtles were captured at OCNGS. This consultation is a reinitiation of the consultation that concluded with NMFS issuance of an Opinion dated November 21, 2006.

A summary (Table 1) is provided below of the takes of sea turtles at the OCNGS from 1992 through October 2011. Figure 1 and Figure 2 provide additional information on these takes. Complete information is provided in a table located in Appendix I. A map illustrating the location of the facility is included as Figure 3.

	Kemp's ridley	Loggerhead	Green	**TOTAL**
1992	1	3*	0	**4**
1993	1	0	0	**1**
1994	2	2	0	**4**
1995	0	0	0	**0**
1996	0	0	0	**0**
1997	1	0	0	**1**
1998	0	1	0	**1**
1999	1	0	1	**2**
2000	2	2	1	**5**
2001	2	0	1	**3**
2002	2	0	0	**2**
2003	1	0	1	**2**
2004	8	0	0	**8**
2005	2	0	0	**2**
2006	4	2	0	**6**
2007	2	0	0	**2**
2008	6	0	0	**6**
2009	10	0	1	**11**
2010	5	1	3	**9**
2011	6	1	1	**8**
TOTAL	**56**	**12**	**9**	**77**

Table 1. Total number of sea turtles captured or impinged at OCNGS from 1992 – October 2011. *Two individual loggerheads were captured in 1992; one was recaptured two days following release into the discharge canal.

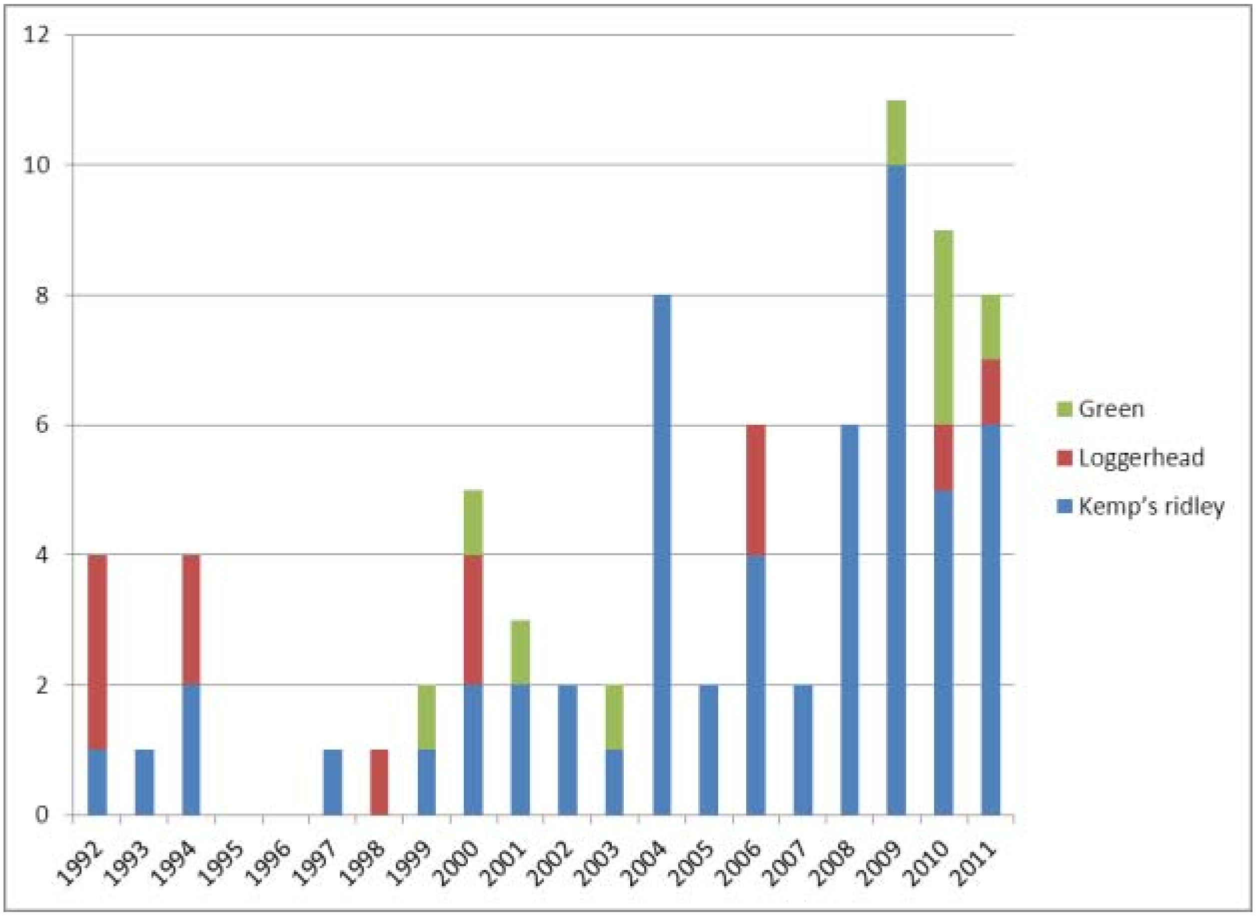


Figure 1. Number of sea turtles taken annually at OCNGS, 1992-2011.

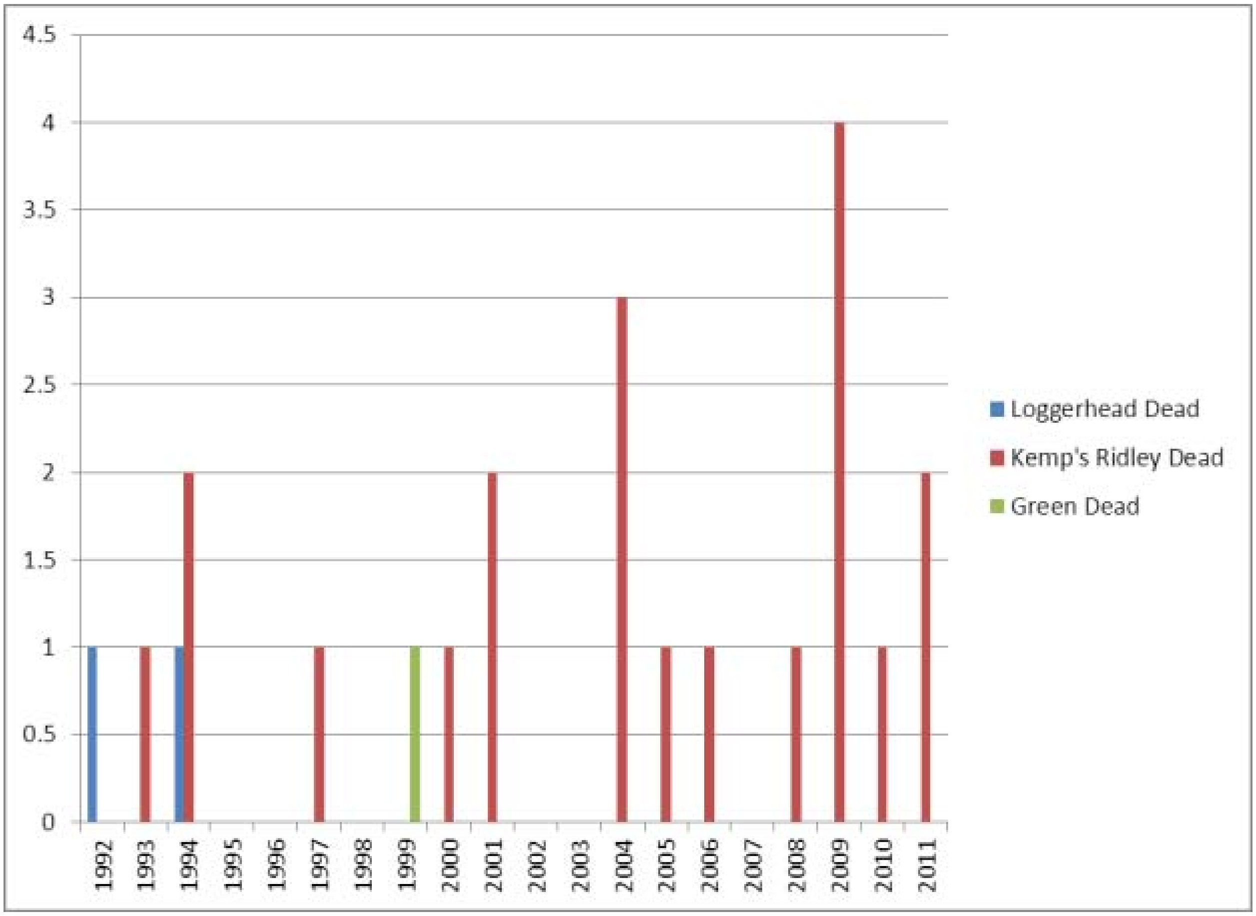
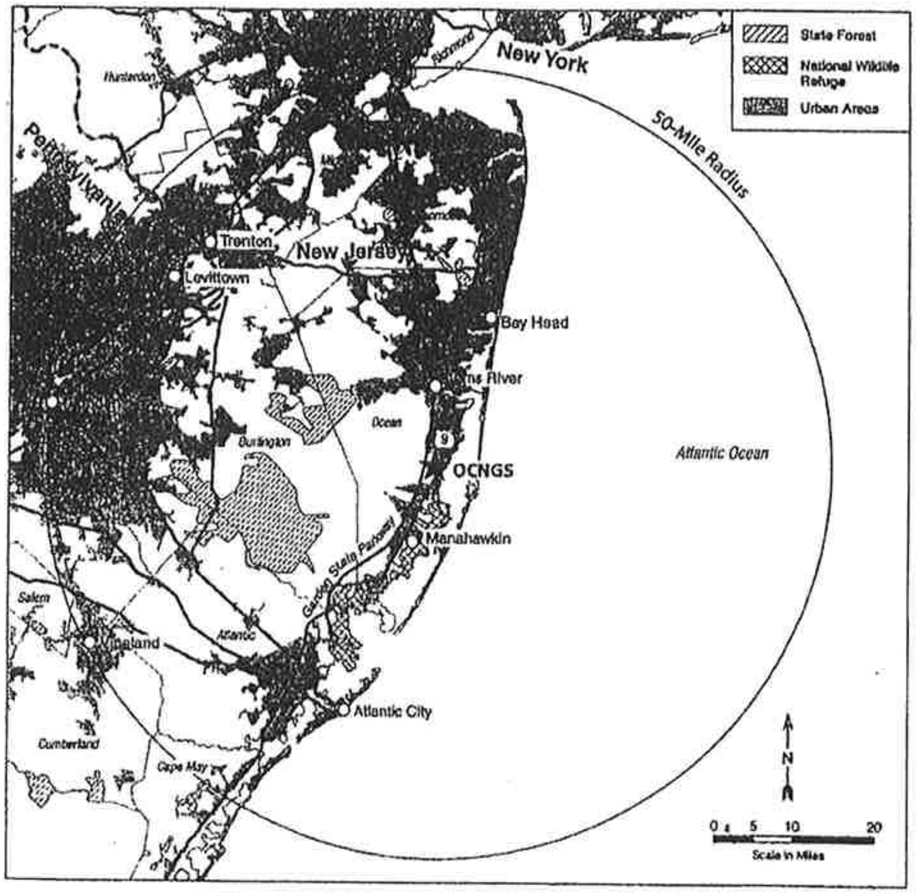
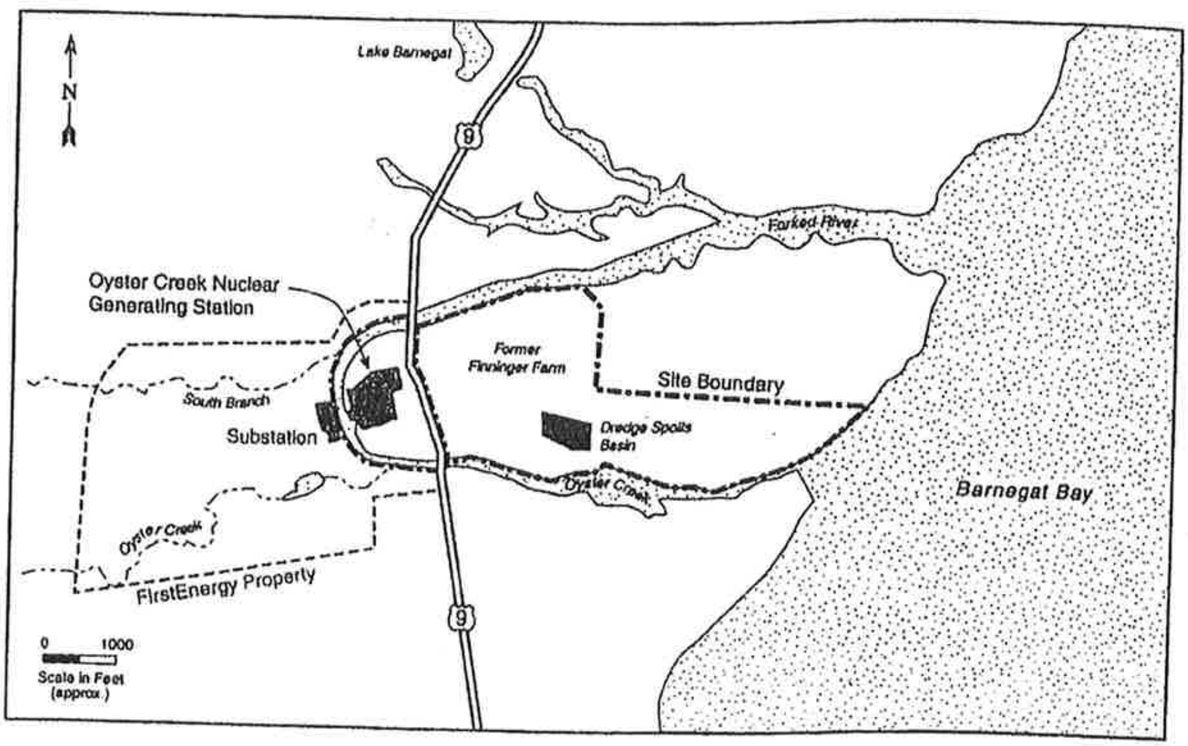


Figure 2. Number of dead sea turtles captured or impinged annually at OCNGS, 1992-2011.

Figure 3. Location of OCNGS.





DESCRIPTION OF THE PROPOSED ACTION

The proposed activity is the continued operation of the Oyster Creek Nuclear Generating Station under the terms of the 2009 license. The license issued by the NRC in April 2009 is valid through April 2029. In December 2010, Exelon, the current owner of the OCNGS, announced that the OCNGS would be closing ten years early and that plant operations would cease in 2019. On October 12, 2011, the NRC issued a letter to Exelon confirming that NRC had received Exelon's notice of intent to permanently cease operations of the OCNGS by no later than December 31, 2019. NMFS requested clarification from the NRC on the status of the OCNGS license after 2019. NRC has indicated that the operating license will remain in effect until April 2029, regardless of Exelon's stated plans to cease operations early. As the term of the license has not changed and because, under the terms of the existing license, operations are authorized until April 9, 2029, NMFS has considered the potential impacts of the continued operation of the facility through the end of its operating license. NMFS anticipates that a future Section 7 consultation between NMFS and NRC would consider effects to listed species from any decommissioning plans or other activities associated with the future termination of operations at OCNGS. As there is no information on future activities currently available, any effects of decommissioning or activities associated with the termination of operations are not knowable at this time.

Details on the operation of the facilities are described below. The Oyster Creek generating units withdraw water from the Forked River and discharge water to Oyster Creek. In 1972, Congress assigned authority to administer the Clean Water Act (CWA) to the US Environmental Protection Agency (EPA). The CWA further allowed EPA to delegate portions of its CWA authority to states. On April 13, 1982, EPA authorized the State of New Jersey to issue National Pollutant Discharge Elimination System (NPDES) permits. New Jersey's NPDES, or State Pollutant Discharge Elimination System (SPDES), program is administered by the NJ Department of Environmental Protection (NJDEP). NJDEP issues and enforces SPDES permits for the OCNGS.

Section 316(b) of the Clean Water Act of 1977 requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impacts (33 USC 1326). EPA regulates impingement and entrainment under Section 316(b) of the CWA through the NPDES permit process. Administration of Section 316(b) has also been delegated to NJDEP, and that provision is implemented through the SPDES program.

OCNGS cannot operate without cooling water. Intake and discharge of water through the cooling water system would not occur but for the operation of the facility pursuant to a renewed license; therefore, the effects of the cooling water system on listed species are a direct effect of the proposed action. NRC staff state that the authority to regulate cooling water intakes and discharges under the CWA lies with EPA, or in this case, NJDEP, as the state has been delegated NPDES authority by EPA. Pursuant to NRC's regulations, operating licenses are conditioned upon compliance with all applicable law, including but not limited to CWA Section 401 Certifications and NPDES/SPDES permits. Therefore, the effects of the proposed Federal action-

- the continued operation of OCNGS pursuant to the 2009 operating license, which necessarily involves the removal and discharge of water from the Forked River and Oyster Creek-- are shaped not only by the terms of the renewed operating license but also by the SPDES permit as issued by the NJDEP. This Opinion will consider the effects of the operation of OCNGS over the remaining term of the operating license pursuant to the Operating License issued by the NRC in 2009 and the SPDES permit issued by NYDEP that is already in effect.

NPDES/SPDES Permits

Section 316(b) of the CWA requires that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available (BTA) for minimizing adverse environmental impacts (33 USC 1326). In July 2004, the EPA published the Phase II Rule implementing Section 316(b) of the CWA for Existing Facilities (69 FR 41576), which applied to large power producers that withdraw large amounts of surface water for cooling (50 MGD or more) (189,000 m^3/day or more). The rule became effective on September 7, 2004 and included numeric performance standards for reductions in impingement mortality and entrainment that would demonstrate that the cooling water intake system constitutes BTA for minimizing impingement and entrainment impacts. Existing facilities subject to the rule were required to demonstrate compliance with the rule's performance standards during the renewal process for their NPDES permit through development of a Comprehensive Demonstration Study (CDS). As a result of a Federal court decision, EPA officially suspended the Phase II rule on July 9, 2007 (72 FR 37107) pending further rulemaking. EPA instructed permitting authorities to utilize best professional judgment in establishing permit requirements on a case by-case basis for cooling water intake structures at Phase II facilities until it has resolved the issues raised by the court's ruling.

Most recently, in 1994, NJDEP issued a SPDES permit for OCNGS. The 1994 permit expired in 1999. Prior to the expiration date, however, the owners of the facility at that time, submitted timely SPDES permit renewal applications to the Department and, by operation of the State Administrative Procedure Act (SAPA), the 1994 SPDES permit was administratively extended.

In July 2006, NJDEP issued a draft SPDES permit for OCNGS that provided two alternatives to mitigate effects of cooling water withdrawal. The first is to reduce intake flow to the level commensurate of that of closed-cycle cooling. The second alternative, should a closed-cycle cooling system be unavailable to OCNGS, is to install and operate a combination of design and construction technologies, operational measures, and restoration measures with the goal of meeting the impingement and entrainment performance standards. The second alternative would also require Exelon to begin a wetlands restoration and enhancement program in the Barnegat Bay watershed. This permit was never finalized. On June 1, 2011, a revised draft SPDES permit was issued to Exelon. No final permit decision has been made to date; however, it is NMFS understanding that operations of OCNGS under a revised SPDES permit are likely to be similar to current operations. However, in a compromise designed to avoid installation of cooling towers, the SPDES permit would require Exelon to cease operations 10 years prior to the expiration of the NRC license. In October 2011, NRC made available a letter sent to Exelon acknowledging Exelon's plans to cease operations by December 31, 2019. As of November 1, 2011, the SPDES permit had not yet been finalized by the State.

In this consultation, NMFS has considered effects of the operation of OCNGS through the remainder of the 20-year extended operating period with the 1994 SPDES permit in effect. This scenario is the one defined by NRC as its proposed action in its Final GSEIS and the BA provided to NMFS in which NRC considered effects of the operation of the facility during the extended operating period on shortnose sturgeon. Therefore, it is the subject of this consultation. However, if a new final SPDES permit is issued, NRC and NMFS would have to determine if reinitiation of this consultation is necessary to consider any effects of the operation of the facility on shortnose sturgeon that were not considered in this Opinion.

Description of OCNGS Operations

The OCNGS facility is located in Lacey Township, New Jersey and lies between the south branch of the Forked River and Oyster Creek. Both streams discharge into Barnegat Bay. The facility was constructed in the 1960s and became operational in December 1969. During construction, a semicircular canal was dredged between the two streams to create a horseshoe shaped cooling water system that consists of the lower reaches or the south branch of the Forked River, the man-made dredged canal and the lower reaches of Oyster Creek (see Figure 4 for a map of the facility). When the plant is operational, the flow direction in the south fork of the Forked River is reversed, and all of the flow goes into the OCNGS.

OCNGS is a single unit plant with a boiling water nuclear reactor and steam turbine. The reactor has a design power level of 1930 megawatts thermal and a net power output of 640 megawatts electric. Plant cooling is provided by a once through system that draws water from Barnegat Bay via the south branch of the Forked River and a man-made intake canal and discharges heat back to Barnegat Bay via a man-made discharge canal and Oyster Creek. Two separate intake structures withdraw water from the intake canal, the circulating water system intake (CWS) and the dilution water system (DWS) intake.

The CWS provides cooling water for the main condensers and for safety-related heat exchangers and other equipment within the station. Water is drawn into the CWS from the intake canal (south fork of the Forked River) through six intake bays and is subsequently discharged into the discharge canal as heated effluent. During normal plant operation, four circulating water pumps withdraw a total of 1740 m^3/min of water. The maximum permissible average intake velocity for water approaching the CWS intake ports is 30 cm/sec. The maximum daily effluent temperature for cooling water discharge back to the discharge canal is 41.1°C.

The DWS is designed to minimize the thermal effects on the discharge canal and Barnegat Bay by thermally diluting the circulating water from the condenser with colder ambient temperature water. Water is pumped from the intake canal through the six intake bays and discharged directly into the discharge canal, where it mixes with and reduces the temperature of the heated effluent from the CWS. A maximum of two dilution pumps are operated at one time, but when ambient water temperature exceeds 30.5°C, usually only one dilution pump is put into operation. The average intake velocity for water in front of the DWS intake (with two pumps in operation) is approximately 73 cm/sec. As expected, the average intake velocity with one DWS pump in operation is notably less than 73 cm/sec.

The dimensions and structures at the CWS are nearly identical to those of the DWS. Several differences are that the intake velocity at the DWS is much higher than at the CWS, and the CWS has a vertical traveling screen to filter small organisms. The intakes at both the CWS and DWS are screened by six sets of trash bars, which extend from the bottom of each intake bay to several feet above the water (7.3 m high and 3.3 m wide). The depth at the intake bays are approximately 4 to 6 meters deep. The trash bars are 0.95 cm wide steel bars set on 7.5 cm centers, and the openings between the trash bars are 6.6 cm wide. A trash rake assembly traverses the entire width of the intake on rails; it contains a trash hopper which transports the material removed from the bars to a debris container. Personnel cleaning the CWS and DWS intake trash racks from June to October observe the trash rake during the cleaning operation so that the rake may be stopped if a sea turtle is sighted. The trash bars are inspected at least once every four hours (i.e., three times during each 12-hour work shift) from June to October to remove debris and to monitor potential sea turtle takes. At the CWS, organisms smaller than 6.6cm travel through the openings onto a traveling screen system where they are washed from the screens and returned to the discharge canal on a slide system. At the DWS, small organisms travel with the dilution water into the discharge canal.

A floating debris/ice barrier is in place upstream of the CWS and DWS intake structures to divert floating debris (e.g., wood, eelgrass, ice) away from the CWS intake and towards the DWS intake. The barrier is intended to prevent excessive amounts of debris or ice from accumulating on the CWS traveling screen or trash bars. The wood floating barrier extends 60 cm below the surface.

Both intakes have sea turtle retrieval/rescue equipment on site in the event of a sea turtle impingement. At the CWS intake structure, a rescue sling suitable for lifting large sea turtles (in excess of 20 kg) is present. Long-handled dip nets are present at the CWS and DWS intake structures during June through October, and are suitable for retrieving the smaller turtles which are more likely to be found at the OCNGS. Both the rescue sling and the long-handled dip nets are only adequate for retrieving turtles from the water surface or within about 1 meter of the surface, as the use of either device requires that the sea turtle be visible from the surface.

Action Area

The action area is defined in 50 CFR 402.02 as “all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action.” The direct and indirect effects of the OCNGS are the intake of water into the CWS and DWS from the south fork of the Forked River, which causes a reversal of normal flow, and the discharge of warmed and chlorinated water into Oyster Creek and Barnegat Bay. The discharge plume occupies Oyster Creek and extends into a relatively large surface area of Barnegat Bay (estimated to be less than 1.6 km in an east-west direction by 5.6 km in a north-south direction, under all conditions). In general, elevated temperatures do not extend to the bottom of the Bay except in the area immediately adjacent to the mouth of Oyster Creek.

The action area for this consultation includes the intake areas of both the DWS and CWS intakes at the OCNGS, the south fork of Forked River, Oyster Creek, and the region where the thermal plume extends into Barnegat Bay from Oyster Creek.

LISTED SPECIES IN THE ACTION AREA

Several species of listed sea turtles under NMFS' jurisdiction occur in New Jersey waters and are likely to occur in the action area. These species include the Northwest Atlantic Distinct Population Segment (NWA DPS) of loggerhead sea turtles, and Kemp's ridley and green sea turtles. Hawksbill and leatherback sea turtles may also occur in New Jersey waters but, as explained below, these species are not likely to occur in the action area for this consultation.

Leatherback sea turtles are widely distributed throughout the oceans of the world, and are found in waters of the Atlantic, Pacific, Caribbean, and the Gulf of Mexico (Ernst and Barbour 1972). In the U.S. Atlantic Ocean, leatherback turtles are found in northeastern waters during the warmer months. This species is found in coastal waters of the continental shelf and near the Gulf Stream edge (Lutcavage 1996). Leatherbacks are predominantly a pelagic species and feed on jellyfish, cnidarians and tunicates; leatherbacks will travel to nearshore areas when in pursuit of these prey species.

Estimated to number approximately 115,000 adult females globally in 1980 (Pritchard 1982) and only 34,500 by 1995 (Spotila *et al.* 1996), leatherback populations have been decimated worldwide, not only by fishery related mortality but, at least historically, due to intense exploitation of eggs on the beach (Ross 1979). The status of the leatherback population in the Atlantic is difficult to assess since major nesting beaches occur over broad areas within tropical waters outside the United States. Recent information suggests that Western Atlantic populations declined from 18,800 nesting females in 1996 (Spotila et al., 1996) to 15,000 nesting females by 2000 (Spotila, pers. comm).

Leatherbacks have been documented in waters off New Jersey and have also been found stranded on New Jersey coastal and estuarine beaches. Shoop and Kenney (1992) observed concentrations of leatherbacks during the summer off the south shore of Long Island and off New Jersey. Leatherbacks in these waters are thought to be following their preferred jellyfish prey. This aerial survey estimated the leatherback population for the northeastern U.S. at approximately 300-600 animals (from near Nova Scotia, Canada to Cape Hatteras, North Carolina).

The only direct access to Barnegat Bay from the Atlantic Ocean is through a single, narrow inlet, approximately 300 m wide. While leatherbacks could enter Barnegat Bay, it is improbable given that this species is rarely found in inshore waters. Furthermore, given this species' distribution and migratory and foraging patterns, it is also unlikely that this species will travel through the navigation channels to reach the OCNGS. No leatherback sea turtles have been observed in Barnegat Bay or at OCNGS. As a result, NMFS has determined that leatherback sea turtles are not likely to occur in the action area for this consultation. As such, this species will not be considered further in this Opinion.

The *hawksbill sea turtle* is relatively uncommon in the waters of the continental United States. Hawksbills prefer coral reefs, such as those found in the Caribbean and Central America. Hawksbills feed primarily on a wide variety of sponges but also consume bryozoans, coelenterates, and mollusks. The Culebra Archipelago of Puerto Rico contains especially important foraging habitat for hawksbills. Nesting areas in the western North Atlantic include Puerto Rico and the Virgin Islands.

There are accounts of hawksbills in south Florida and a number are encountered in Texas each year. Most of the Texas records report small turtles, probably in the 1-2 year class range. Many of the captures or strandings that are reported are of individuals in an unhealthy or injured condition. The lack of sponge-covered reefs and the cold winters in the northern Gulf of Mexico probably prevent hawksbills from establishing a viable population in this area. In the north Atlantic, small hawksbills have stranded as far north as Cape Cod, Massachusetts. However, many of these strandings were observed after hurricanes or offshore storms.

While hawksbills have occasionally been found in northern mid-Atlantic waters, it is improbable that this species will be present in the action area given its distribution, and migratory and foraging patterns. No hawksbill sea turtles have been observed in Barnegat Bay or at OCNGS. As a result, NMFS has determined that hawksbill sea turtles are not likely to occur in the action area for this consultation. As such, this species will not be considered further in this Opinion.

Status of Sea Turtles

With the exception of loggerheads, sea turtles are listed under the ESA at the species level rather than as subspecies or distinct population segments (DPS). Therefore, information on the range-wide status of Kemp's ridley and green sea turtles is included to provide the status of each species, overall. Information on the status of loggerheads will only be presented for the DPS affected by this action. Additional background information on the range-wide status of these species can be found in a number of published documents, including sea turtle status reviews and biological reports (NMFS and USFWS 1995; Hirth 1997; Marine Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; NMFS and USFWS 2007a, 2007b, 2007c, 2007d; Conant *et al*. 2009), and recovery plans for the loggerhead sea turtle (NMFS and USFWS 2008), Kemp's ridley sea turtle (NMFS et al. 2011), and green sea turtle (NMFS and USFWS 1991, 1998b).

2010 BP Deepwater Horizon Oil Spill

The April 20, 2010, explosion of the Deepwater Horizon oil rig affected sea turtles in the Gulf of Mexico. There is an on-going assessment of the long-term effects of the spill on Gulf of Mexico marine life, including sea turtle populations. Following the spill, juvenile Kemp's ridley, green, and loggerhead sea turtles were found in *Sargassum* algae mats in the convergence zones, where currents meet and oil collected. Sea turtles found in these areas were often coated in oil and/or had ingested oil. Approximately 536 live adult and juvenile sea turtles were recovered from the Gulf and brought into rehabilitation centers; of these, 456 were visibly oiled (these and the following numbers were obtained from http://www.nmfs.noaa.gov/pr/health/oilspill/). To date, 469 of the live recovered sea turtles have been successfully returned to the wild, 25 died during rehabilitation, and 42 are still in care but will hopefully be returned to the wild eventually. During the clean-up period, 613 dead sea turtles were recovered in coastal waters or on beaches in Mississippi, Alabama, Louisiana, and the Florida Panhandle. As of February 2011, 478 of these dead turtles had been examined. Many of the examined sea turtles showed indications that they had died as a result of interactions with trawl gear, most likely used in the shrimp fishery, and not as a result of exposure to or ingestion of oil.

During the spring and summer of 2010, nearly 300 sea turtle nests were relocated from the northern Gulf to the east coast of Florida with the goal of preventing hatchlings from entering the oiled waters of the northern Gulf. From these relocated nests, 14,676 sea turtles, including 14,235 loggerheads, 125 Kemp's ridleys, and 316 greens, were ultimately released from Florida beaches.

A thorough assessment of the long-term effects of the spill on sea turtles has not yet been completed. However, the spill resulted in the direct mortality of many sea turtles and may have had sublethal effects or caused environmental damage that will impact other sea turtles into the future. The population level effects of the spill and associated response activity are likely to remain unknown for some period into the future.

Loggerhead sea turtle

The loggerhead is the most abundant species of sea turtle in U.S. waters. Loggerhead sea turtles are found in temperate and subtropical waters and occupy a range of habitats including offshore waters, continental shelves, bays, estuaries, and lagoons. They are also exposed to a variety of natural and anthropogenic threats in the terrestrial and marine environment.

Listing History

Loggerhead sea turtles were listed as threatened throughout their global range on July 28, 1978. Since that time, several status reviews have been conducted to review the status of the species and make recommendations regarding its ESA listing status. Based on a 2007 5-year status review of the species, which discussed a variety of threats to loggerheads including climate change, NMFS and FWS determined that loggerhead sea turtles should not be delisted or reclassified as endangered. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified for the loggerhead (NMFS and USFWS 2007a). Genetic differences exist between loggerhead sea turtles that nest and forage in the different ocean basins (Bowen 2003; Bowen and Karl 2007). Differences in the maternally inherited mitochondrial DNA also exist between loggerhead nesting groups that occur within the same ocean basin (TEWG 2000; Pearce 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007; TEWG 2009; NMFS and USFWS 2008). Site fidelity of females to one or more nesting beaches in an area is believed to account for these genetic differences (TEWG 2000; Bowen 2003).

In part to evaluate those genetic differences, in 2008, NMFS and FWS established a Loggerhead Biological Review Team (BRT) to assess the global loggerhead population structure to determine whether DPSs exist and, if so, the status of each DPS. The BRT evaluated genetic data, tagging and telemetry data, demographic information, oceanographic features, and geographic barriers to determine whether population segments exist. The BRT report was completed in August 2009 (Conant *et al*. 2009). In this report, the BRT identified the following nine DPSs as being discrete from other conspecific population segments and significant to the species: (1) North Pacific Ocean, (2) South Pacific Ocean, (3) North Indian Ocean, (4) Southeast Indo-Pacific Ocean, (5) Southwest Indian Ocean, (6) Northwest Atlantic Ocean, (7) Northeast Atlantic Ocean, (8) Mediterranean Sea, and (9) South Atlantic Ocean.

The BRT concluded that although some DPSs are indicating increasing trends at nesting beaches (Southwest Indian Ocean and South Atlantic Ocean), available information about anthropogenic threats to juveniles and adults in neritic and oceanic environments indicate possible unsustainable additional mortalities. According to an analysis using expert opinion in a matrix model framework, the BRT report stated that all loggerhead DPSs have the potential to decline in the foreseeable future. Based on the threat matrix analysis, the potential for future decline was reported as greatest for the North Indian Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, Mediterranean Sea, and South Atlantic Ocean DPSs (Conant *et al*. 2009). The BRT concluded that the North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Southeast Indo-Pacific Ocean, Northwest Atlantic Ocean, Northeast Atlantic Ocean, and Mediterranean Sea DPSs were at risk of extinction. The BRT concluded that although the Southwest Indian Ocean and South Atlantic Ocean DPSs were likely not currently at immediate risk of extinction, the extinction risk was likely to increase in the foreseeable future.

On March 16, 2010, NMFS and USFWS published a proposed rule (75 FR 12598) to divide the worldwide population of loggerhead sea turtles into nine DPSs, as described in the 2009 Status Review. Two of the DPSs were proposed to be listed as threatened and seven of the DPSs, including the Northwest Atlantic Ocean DPS, were proposed to be listed as endangered. NMFS and the USFWS accepted comments on the proposed rule through September 13, 2010 (75 FR 30769, June 2, 2010). On March 22, 2011 (76 FR 15932), NMFS and USFWS extended the date by which a final determination on the listing action will be made to no later than September 16, 2011. This action was taken to address the interpretation of the existing data on status and trends and its relevance to the assessment of risk of extinction for the Northwest Atlantic Ocean DPS, as well as the magnitude and immediacy of the fisheries bycatch threat and measures to reduce this threat. New information or analyses to help clarify these issues were requested by April 11, 2011.

On September 22, 2011, NMFS and USFWS issued a final rule (76 FR 58868), determining that the loggerhead sea turtle is composed of nine DPSs (as defined in Conant *et al*., 2009) that constitute species that may be listed as threatened or endangered under the ESA. Five DPSs were listed as endangered (North Pacific Ocean, South Pacific Ocean, North Indian Ocean, Northeast Atlantic Ocean, and Mediterranean Sea), and four DPSs were listed as threatened (Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest

Indian Ocean). Note that the Northwest Atlantic Ocean (NWA) DPS and the Southeast Indo-Pacific Ocean DPS were original proposed as endangered. The NWA DPS was determined to be threatened based on review of nesting data available after the proposed rule was published, information provided in public comments on the proposed rule, and further discussions within the agencies. The two primary factors considered were population abundance and population trend. NMFS and USFWS found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats. This final listing rule became effective on October 25, 2011.

The September 2011 final rule also noted that critical habitat for the two DPSs occurring within the U.S. (NWA DPS and North Pacific DPS) will be designated in a future rulemaking. Information from the public related to the identification of critical habitat, essential physical or biological features for this species, and other relevant impacts of a critical habitat designation was solicited. Currently, no critical habitat is designated for any DPS of loggerhead sea turtles, and therefore, no critical habitat for any DPS occurs in the action area.

Presence of loggerhead sea turtles in the action area

The effects of this proposed action are only experienced within New Jersey state waters. NMFS has considered the available information on the distribution of the 9 DPSs to determine the origin of any loggerhead sea turtles that may occur in the action area. As noted in Conant *et al*. (2009), the range of the four DPSs occurring in the Atlantic Ocean are as follows: NWA DPS – north of the equator, south of 60° N latitude, and west of 40° W longitude; Northeast Atlantic Ocean (NEA) DPS – north of the equator, south of 60° N latitude, east of 40° W longitude, and west of 5° 36’ W longitude; South Atlantic DPS – south of the equator, north of 60° S latitude, west of 20° E longitude, and east of 60° W longitude; Mediterranean DPS – the Mediterranean Sea east of 5° 36’ W longitude. These boundaries were determined based on oceanographic features, loggerhead sightings, thermal tolerance, fishery bycatch data, and information on loggerhead distribution from satellite telemetry and flipper tagging studies. While adults are highly structured with no overlap, there may be some degree of overlap by juveniles of the NWA, NEA, and Mediterranean DPSs on oceanic foraging grounds (Laurent *et al*. 1993, 1998; Bolten *et al*. 1998; LaCasella *et al*. 2005; Carreras *et al*. 2006, Monzón-Argüello *et al*. 2006; Revelles *et al*. 2007). Previous literature (Bowen *et al*. 2004) has suggested that there is the potential, albeit small, for some juveniles from the Mediterranean DPS to be present in U.S. Atlantic coastal foraging grounds. These conclusions must be interpreted with caution however, as they may be representing a shared common haplotype and lack of representative sampling at Eastern Atlantic rookeries rather than an actual presence of Mediterranean DPS turtles in US Atlantic coastal waters. A re-analysis of the data by the Atlantic loggerhead Turtle Expert Working Group has found that that it is unlikely that U.S. fishing fleets are interacting with either the Northeast Atlantic loggerhead DPS or the Mediterranean loggerhead DPS (Peter Dutton, NMFS, Marine Turtle Genetics Program, Program Leader, personal communication, September 10, 2011). Given that the action area is a subset of the area fished by US fleets, it is reasonable to assume that based on this new analysis, no individuals from the Mediterranean DPS or Northeast Atlantic DPS would be present in the action area. Sea turtles of the South Atlantic DPS do not inhabit the action area of this consultation (Conant *et al*. 2009). As such, the remainder of this consultation will only focus on the NWA DPS, listed as threatened.

Distribution and Life History

Ehrhart *et al.* (2003) provided a summary of the literature identifying known nesting habitats and foraging areas for loggerheads within the Atlantic Ocean. Detailed information is also provided in the 5-year status review for loggerheads (NMFS and USFWS 2007a), the TEWG report (2009), and the final revised recovery plan for loggerheads in the Northwest Atlantic Ocean (NMFS and USFWS 2008), which is a second revision to the original recovery plan that was approved in 1984 and subsequently revised in 1991.

In the western Atlantic, waters as far north as 41° N to 42° N latitude are used for foraging by juveniles, as well as adults (Shoop 1987; Shoop and Kenney 1992; Ehrhart *et al.* 2003; Mitchell *et al.* 2003). In U.S. Atlantic waters, loggerheads commonly occur throughout the inner continental shelf from Florida to Cape Cod, Massachusetts and in the Gulf of Mexico from Florida to Texas, although their presence varies with the seasons due to changes in water temperature (Shoop and Kenney 1992; Epperly *et al.* 1995a, 1995b; Braun and Epperly 1996; Braun-McNeill *et al.* 2008; Mitchell *et al.* 2003). Loggerheads have been observed in waters with surface temperatures of 7°C to 30°C, but water temperatures ≥11°C are most favorable (Shoop and Kenney 1992; Epperly *et al.* 1995b). The presence of loggerhead sea turtles in U.S. Atlantic waters is also influenced by water depth. Aerial surveys of continental shelf waters north of Cape Hatteras, North Carolina indicated that loggerhead sea turtles were most commonly sighted in waters with bottom depths ranging from 22 m to 49 m deep (Shoop and Kenney 1992). However, more recent survey and satellite tracking data support that they occur in waters from the beach to beyond the continental shelf (Mitchell *et al.* 2003; Braun-McNeill and Epperly 2004; Mansfield 2006; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield et al. 2009).

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

Recent studies have established that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002; Blumenthal *et al.* 2006; Hawkes *et al.* 2006; McClellan and Read 2007; Mansfield *et al*. 2009). One of the studies tracked the movements of adult post-nesting females and found that differences in habitat use were related to body size with larger adults staying in coastal waters and smaller adults traveling to oceanic waters (Hawkes *et al.* 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters and others moving off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes *et al.* (2006) study, there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007).

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988; NMFS and USFWS 2008). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats (NMFS and USFWS 2008).

As presented below, Table 3 from the 2008 loggerhead recovery plan highlights the key life history parameters for loggerheads nesting in the United States.

Table 3. Typical values of life history parameters for loggerheads nesting in the U.S.

Life History Parameter	**Data**
Clutch size	100-126 eggs[1]
Egg incubation duration (varies depending on time of year and latitude)	42-75 days[2,3]
Pivotal temperature (incubation temperature that produces an equal number of males and females)	29.0°C[5]
Nest productivity (emerged hatchlings/total eggs) x 100 (varies depending on site specific factors)	45-70%[2,6]
Clutch frequency (number of nests/female/season)	3-5.5 nests[7]
Internesting interval (number of days between successive nests within a season)	12-15 days[8]
Juvenile (<87 cm CCL) sex ratio	65-70% female[4]
Remigration interval (number of years between successive nesting migrations)	2.5-3.7 years[9]
Nesting season	late April-early September
Hatching season	late June-early November
Age at sexual maturity	32-35 years[10]
Life span	>57 years[11]

1 Dodd 1988.
2 Dodd and Mackinnon (1999, 2000, 2001, 2002, 2003, 2004).
3 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=865).
4 National Marine Fisheries Service (2001); Allen Foley, FFWCC, personal communication, 2005.
5 Mrosovsky (1988).
6 Blair Witherington, FFWCC, personal communication, 2006 (information based on nests monitored throughout Florida beaches in 2005, n=1,680).
7 Murphy and Hopkins (1984); Frazer and Richardson (1985); Ehrhart, unpublished data; Hawkes *et al*. 2005; Scott 2006; Tony Tucker, Mote Marine Laboratory, personal communication, 2008.
8 Caldwell (1962), Dodd (1988).
9 Richardson *et al*. (1978); Bjorndal *et al*. (1983); Ehrhart, unpublished data.
10 Melissa Snover, NMFS, personal communication, 2005; see Table A1-6.
11 Dahlen *et al*. (2000).

<u>Population Dynamics and Status</u>

By far, the majority of Atlantic nesting occurs on beaches of the southeastern United States (NMFS and USFWS 2007a). For the past decade or so, the scientific literature has recognized five distinct nesting groups, or subpopulations, of loggerhead sea turtles in the Northwest

Atlantic, divided geographically as follows: (1) a northern group of nesting females that nest from North Carolina to northeast Florida at about 29° N latitude; (2) a south Florida group of nesting females that nest from 29° N latitude on the east coast to Sarasota on the west coast; (3) a Florida Panhandle group of nesting females that nest around Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán group of nesting females that nest on beaches of the eastern Yucatán Peninsula, Mexico; and (5) a Dry Tortugas group that nests on beaches of the islands of the Dry Tortugas, near Key West, Florida and on Cal Sal Bank (TEWG 2009). Genetic analyses of mitochondrial DNA, which a sea turtle inherits from its mother, indicate that there are genetic differences between loggerheads that nest at and originate from the beaches used by each of the five identified nesting groups of females (TEWG 2009). However, analyses of microsatellite loci from nuclear DNA, which represents the genetic contribution from both parents, indicates little to no genetic differences between loggerheads originating from nesting beaches of the five Northwest Atlantic nesting groups (Pearce and Bowen 2001; Bowen 2003; Bowen *et al.* 2005; Shamblin 2007). These results suggest that female loggerheads have site fidelity to nesting beaches within a particular area, while males provide an avenue of gene flow between nesting groups by mating with females that originate from different nesting groups (Bowen 2003; Bowen *et al.* 2005). The extent of such gene flow, however, is unclear (Shamblin 2007).

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

In the 2008 recovery plan, the Loggerhead Recovery Team designated five recovery units for the Northwest Atlantic population of loggerhead sea turtles based on the aforementioned nesting groups and inclusive of a few other nesting areas not mentioned above. The first four of these recovery units represent nesting assemblages located in the Southeast United States. The fifth recovery unit is composed of all other nesting assemblages of loggerheads within the Greater Caribbean, outside the United States, but which occur within U.S. waters during some portion of their lives. The five recovery units representing nesting assemblages are: (1) the Northern Recovery Unit (NRU: Florida/Georgia border through southern Virginia), (2) the Peninsular Florida Recovery Unit (PFRU: Florida/Georgia border through Pinellas County, Florida), (3) the Dry Tortugas Recovery Unit (DTRU: islands located west of Key West, Florida), (4) the Northern Gulf of Mexico Recovery Unit (NGMRU: Franklin County, Florida through Texas), and (5) the Greater Caribbean Recovery Unit (GCRU: Mexico through French Guiana, Bahamas, Lesser Antilles, and Greater Antilles).

The Recovery Team evaluated the status and trends of the Northwest Atlantic loggerhead population for each of the five recovery units, using nesting data available as of October 2008 (NMFS and USFWS 2008). The level and consistency of nesting coverage varies among recovery units, with coverage in Florida generally being the most consistent and thorough over time. Since 1989, nest count surveys in Florida have occurred in the form of statewide surveys (a near complete census of entire Florida nesting) and index beach surveys (Witherington *et al.* 2009). Index beaches were established to standardize data collection methods and maintain a constant level of effort on key nesting beaches over time.

Note that NMFS and USFWS (2008), Witherington *et al*. (2009), and TEWG (2009) analyzed the status of the nesting assemblages within the NWA DPS using standardized data collected over periods ranging from 10-23 years. These analyses used different analytical approaches, but found the same finding that there had been a significant, overall nesting decline within the NWA DPS. However, with the addition of nesting data from 2008-2010, the trend line changes showing a very slight negative trend, but the rate of decline is not statistically different from zero (76 FR 58868, September 22, 2011). The nesting data presented in the Recovery Plan (through 2008) is described below, with updated trend information through 2010 for two recovery units.

From the beginning of standardized index surveys in 1989 until 1998, the PFRU, the largest nesting assemblage in the Northwest Atlantic by an order of magnitude, had a significant increase in the number of nests. However, from 1998 through 2008, there was a 41% decrease in annual nest counts from index beaches, which represent an average of 70% of the statewide nesting activity (NMFS and USFWS 2008). From 1989-2008, the PFRU had an overall declining nesting trend of 26% (95% CI: -42% to -5%; NMFS and USFWS 2008). With the addition of nesting data through 2010, the nesting trend for the PFRU does not show a nesting decline statistically different from zero (76 FR 58868, September 22, 2011). The NRU, the second largest nesting assemblage of loggerheads in the United States, has been declining at a rate of 1.3% annually since 1983 (NMFS and USFWS 2008). The NRU dataset included 11 beaches with an uninterrupted time series of coverage of at least 20 years; these beaches represent approximately 27% of NRU nesting (in 2008). Through 2008, there was strong statistical data to suggest the NRU has experienced a long-term decline, but with the inclusion of nesting data through 2010, nesting for the NRU is showing possible signs of stabilizing (76 FR 58868, September 22, 2011). Evaluation of long-term nesting trends for the NGMRU is difficult because of changed and expanded beach coverage. However, the NGMRU has shown a significant declining trend of 4.7% annually since index nesting beach surveys were initiated in 1997 (NMFS and USFWS 2008). No statistical trends in nesting abundance can be determined for the DTRU because of the lack of long-term data. Similarly, statistically valid analyses of long-term nesting trends for the entire GCRU are not available because there are few long-term standardized nesting surveys representative of the region. Additionally, changing survey effort at monitored beaches and scattered and low-level nesting by loggerheads at many locations currently precludes comprehensive analyses (NMFS and USFWS 2008).

Sea turtle census nesting surveys are important in that they provide information on the relative abundance of nesting each year, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 2008 recovery plan compiled information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (*i.e*., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year (from 1989-2008) with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year (from 1989-2007) with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year (from 1995-2004, excluding 2002) with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year (from 1995-2007) with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit. Note that the above values for average nesting females per year were based upon 4.1 nests per female per Murphy and Hopkins (1984).

Genetic studies of juvenile and a few adult loggerhead sea turtles collected from Northwest Atlantic foraging areas (beach strandings, a power plant in Florida, and North Carolina fisheries) show that the loggerheads that occupy East Coast U.S. waters originate from these Northwest Atlantic nesting groups; primarily from the nearby nesting beaches of southern Florida, as well as the northern Florida to North Carolina beaches, and finally from the beaches of the Yucatán Peninsula, Mexico (Rankin-Baransky *et al*. 2001; Witzell *et al*. 2002; Bass *et al.* 2004; Bowen *et al*. 2004). The contribution of these three nesting assemblages varies somewhat among the foraging habitats and age classes surveyed along the east coast. The distribution is not random and bears a significant relationship to the proximity and size of adjacent nesting colonies (Bowen *et al*. 2004). Bass *et al*. (2004) attribute the variety in the proportions of sea turtles from loggerhead turtle nesting assemblages documented in different east coast foraging habitats to a complex interplay of currents and the relative size and proximity of nesting beaches.

Unlike nesting surveys, in-water studies of sea turtles typically sample both sexes and multiple age classes. In-water studies have been conducted in some areas of the Northwest Atlantic and provide data by which to assess the relative abundance of loggerhead sea turtles and changes in abundance over time (Maier *et al.* 2004; Morreale *et al.* 2005; Mansfield 2006; Ehrhart *et al.* 2007; Epperly *et al.* 2007). The TEWG (2009) used raw data from six in-water study sites to conduct trend analyses. They identified an increasing trend in the abundance of loggerheads from three of the four sites located in the Southeast United States, one site showed no discernible trend, and the two sites located in the northeast United States showed a decreasing trend in abundance of loggerheads. The 2008 loggerhead recovery plan also includes a full discussion of in-water population studies for which trend data have been reported, and a brief summary will be provided here.

Maier *et al.* (2004) used fishery-independent trawl data to establish a regional index of loggerhead abundance for the southeast coast of the United States (Winyah Bay, South Carolina to St. Augustine, Florida) during the period 2000-2003. A comparison of loggerhead catch data from this study with historical values suggested that in-water populations of loggerhead sea turtles along the southeast U.S. coast appear to be larger, possibly an order of magnitude higher than they were 25 years ago, but the authors caution a direct comparison between the two studies given differences in sampling methodology (Maier *et al.* 2004). A comparison of catch rates for sea turtles in pound net gear fished in the Pamlico-Albemarle Estuarine Complex of North Carolina between the years 1995-1997 and 2001-2003 found a significant increase in catch rates for loggerhead sea turtles for the latter period (Epperly *et al.* 2007). A long-term, on-going study of loggerhead abundance in the Indian River Lagoon System of Florida found a significant increase in the relative abundance of loggerheads over the last 4 years of the study (Ehrhart *et al.* 2007). However, there was no discernible trend in loggerhead abundance during the 24-year time period of the study (1982-2006) (Ehrhart *et al.* 2007). At St. Lucie Power Plant, data collected from 1977-2004 show an increasing trend of loggerheads at the power plant intake structures (FPL and Quantum Resources 2005).

In contrast to these studies, Morreale *et al.* (2005) observed a decline in the percentage and relative numbers of loggerhead sea turtles incidentally captured in pound net gear fished around Long Island, New York during the period 2002-2004 in comparison to the period 1987-1992, with only two loggerheads (of a total 54 turtles) observed captured in pound net gear during the period 2002-2004. This is in contrast to the previous decade's study where numbers of individual loggerheads ranged from 11 to 28 per year (Morreale *et al.* 2005). No additional loggerheads were reported captured in pound net gear in New York through 2007, although two were found cold-stunned on Long Island bay beaches in the fall of 2007 (Memo to the File, L. Lankshear, December 2007). Potential explanations for this decline include major shifts in loggerhead foraging areas and/or increased mortality in pelagic or early benthic stage/age classes (Morreale *et al.* 2005). Using aerial surveys, Mansfield (2006) also found a decline in the densities of loggerhead sea turtles in Chesapeake Bay over the period 2001-2004 compared to aerial survey data collected in the 1980s. Significantly fewer loggerheads ($p<0.05$) were observed in both the spring (May-June) and the summer (July-August) of 2001-2004 compared to those observed during aerial surveys in the 1980s (Mansfield 2006). A comparison of median densities from the 1980s to the 2000s suggested that there had been a 63.2% reduction in densities during the spring residency period and a 74.9% reduction in densities during the summer residency period (Mansfield 2006). The decline in observed loggerhead populations in Chesapeake Bay may be related to a significant decline in prey, namely horseshoe crabs and blue crabs, with loggerheads redistributing outside of Bay waters (NMFS and USFWS 2008).

As with other turtle species, population estimates for loggerhead sea turtles are difficult to determine, largely given their life history characteristics. However, a recent loggerhead assessment using a demographic matrix model estimated that the loggerhead adult female population in the western North Atlantic ranges from 16,847 to 89,649, with a median size of 30,050 (NMFS SEFSC 2009). The model results for population trajectory suggest that the population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. The pelagic stage survival parameter had the largest effect on the model results. As a result of the large uncertainty in our knowledge of loggerhead life history, at this point predicting the future populations or population trajectories of loggerhead sea turtles with precision is very uncertain. It should also be noted that additional analyses are underway which will incorporate any newly available information.

As part of the Atlantic Marine Assessment Program for Protected Species (AMAPPS), line transect aerial abundance surveys and turtle telemetry studies were conducted along the Atlantic coast in the summer of 2010. AMAPPS is a multi-agency initiative to assess marine mammal, sea turtle, and seabird abundance and distribution in the Atlantic. Aerial surveys were conducted from Cape Canaveral, Florida to the Gulf of St. Lawrence, Canada. Satellite tags on juvenile loggerheads were deployed in two locations – off the coasts of northern Florida to South Carolina (n=30) and off the New Jersey and Delaware coasts (n=14). As presented in NMFS NEFSC (2011), the 2010 survey found a preliminary total surface abundance estimate within the entire study area of about 60,000 loggerheads (CV=0.13) or 85,000 if a portion of unidentified hard-shelled sea turtles were included (CV=0.10). Surfacing times were generated from the satellite tag data collected during the aerial survey period, resulting in a 7% (5%-11% inter-quartile range) median surface time in the South Atlantic area and a 67% (57%-77% inter-quartile range) median surface time to the north. The calculated preliminary regional abundance estimate is about 588,000 loggerheads along the U.S. Atlantic coast, with an inter-quartile range of 382,000-817,000 (NMFS NEFSC 2011). The estimate increases to approximately 801,000 (inter-quartile range of 521,000-1,111,000) when based on known loggerheads and a portion of unidentified turtle sightings. The density of loggerheads was generally lower in the north than the south; based on number of turtle groups detected, 64% were seen south of Cape Hatteras, North Carolina, 30% in the southern Mid-Atlantic Bight, and 6% in the northern Mid-Atlantic Bight. Although they have been seen farther north in previous studies (*e.g.*, Shoop and Kenney 1992), no loggerheads were observed during the aerial surveys conducted in the summer of 2010 in the more northern zone encompassing Georges Bank, Cape Cod Bay, and the Gulf of Maine. These estimates of loggerhead abundance over the U.S. Atlantic continental shelf are considered very preliminary. A more thorough analysis will be completed pending the results of further studies related to improving estimates of regional and seasonal variation in loggerhead surface time (by increasing the sample size and geographical area of tagging) and other information needed to improve the biases inherent in aerial surveys of sea turtles (*e.g.*, research on depth of detection and species misidentification rate). This survey effort represents the most comprehensive assessment of sea turtle abundance and distribution in many years. Additional aerial surveys and research to improve the abundance estimates are anticipated in 2011-2014, depending on available funds.

Threats

The diversity of a sea turtle's life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the neritic environment, and in the oceanic environment. The 5-year status review and 2008 recovery plan provide a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007a, 2008). Amongst those of natural origin, hurricanes are known to be destructive to sea turtle nests. Sand accretion, rainfall, and wave action that result from these storms can appreciably reduce hatchling success. Other sources of natural mortality include cold-stunning, biotoxin exposure, and native species predation.

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

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

A 1990 National Research Council (NRC) report concluded that for juveniles, subadults, and breeders in coastal waters, the most important source of human caused mortality in U.S. Atlantic waters was fishery interactions. The sizes and reproductive values of sea turtles taken by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that takes greater numbers of less reproductively valuable turtles (Wallace *et al*. 2008). 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). Attaining a more thorough understanding of the characteristics, as well as the quantity of sea turtle bycatch across all fisheries is of great importance.

Of the many fisheries known to adversely affect loggerheads, the U.S. South Atlantic and Gulf of Mexico shrimp fisheries were considered to pose the greatest threat of mortality to neritic juvenile and adult age classes of loggerheads, accounting for an estimated 5,000 to 50,000 loggerhead deaths each year (NRC 1990). Significant changes to the South Atlantic and Gulf of Mexico shrimp fisheries have occurred since 1990, and the effects of these shrimp fisheries on ESA-listed species, including loggerhead sea turtles, have been assessed several times through section 7 consultation. There is also a lengthy regulatory history with regard to the use of Turtle Excluder Devices (TEDs) in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (Epperly and Teas 2002; NMFS 2002a; Lewison *et al.* 2003). The current section 7 consultation on the U.S. South Atlantic and Gulf of Mexico shrimp fisheries was completed in 2002 and estimated the total annual level of take for loggerhead sea turtles to be 163,160 interactions (the total number of turtles that enter a shrimp trawl, which may then escape through the TED or fail to escape and be captured) with 3,948 of those takes being lethal (NMFS 2002a).

In addition to improvements in TED designs and TED enforcement, interactions between loggerheads and the shrimp fishery have also been declining because of reductions in fishing effort unrelated to fisheries management actions. The 2002 Opinion take estimates are based in part on fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacted the shrimp fleets; in some cases reducing fishing effort by as much as 50% for offshore waters of the Gulf of Mexico (GMFMC 2007). As a result, loggerhead interactions and mortalities in the Gulf of Mexico have been substantially less than projected in the 2002 Opinion. Currently, the estimated annual number of interactions between loggerheads and shrimp trawls in the Gulf of Mexico shrimp fishery is 23,336, with 647 (2.8%) of those interactions resulting in mortality (Memo from Dr. B. Ponwith, Southeast Fisheries Science Center to Dr. R. Crabtree, Southeast Region, PRD, December 2008). Section 7 consultation on the Shrimp FMP has recently been reinitiated and a new Biological Opinion is forthcoming.

Loggerhead sea turtles are also known to interact with non-shrimp trawl, gillnet, longline, dredge, pound net, pot/trap, and hook and line fisheries. The NRC (1990) report stated that other U.S. Atlantic fisheries collectively accounted for 500 to 5,000 loggerhead deaths each year, but recognized that there was considerable uncertainty in the estimate. The reduction of sea turtle captures in fishing operations is identified in recovery plans and 5-year status reviews as a priority for the recovery of all sea turtle species. In the threats analysis of the loggerhead recovery plan, trawl bycatch is identified as the greatest source of mortality. While loggerhead bycatch in U.S. Mid-Atlantic bottom otter trawl gear was previously estimated for the period 1996-2004 (Murray 2006, 2008), a recent bycatch analysis estimated the number of loggerhead sea turtle interactions with U.S. Mid-Atlantic bottom trawl gear from 2005-2008 (Warden 2011a). Northeast Fisheries Observer Program data from 1994-2008 were used to develop a model of interaction rates and those predicted rates were applied to 2005-2008 commercial fishing data to estimate the number of interactions for the trawl fleet. The number of predicted average annual loggerhead interactions for 2005-2008 was 292 (CV=0.13, 95% CI=221-369), with an additional 61 loggerheads (CV=0.17, 95% CI=41-83) interacting with trawls but being released through a TED. Of the 292 average annual observable loggerhead interactions, approximately 44 of those were adult equivalents. Warden (2011b) found that latitude, depth and SST were associated with the interaction rate, with the rates being highest south of 37°N latitude in waters < 50 m deep and SST > 15°C. This estimate is a decrease from the average annual loggerhead bycatch in bottom otter trawls during 1996-2004, estimated to be 616 sea turtles (CV=0.23, 95% CI over the 9-year period: 367-890) (Murray 2006, 2008).

There have been several published estimates of the number of loggerheads taken annually as a result of the dredge fishery for Atlantic sea scallops, ranging from a low of zero in 2005 (Murray 2007) to a high of 749 in 2003 (Murray 2004). Murray (2011) recently re-evaluated loggerhead sea turtle interactions in scallop dredge gear from 2001-2008. In that paper, the average number of annual observable interactions of hard-shelled sea turtles in the Mid-Atlantic scallop dredge fishery prior to the implementation of chain mats (January 1, 2001 through September 25, 2006) was estimated to be 288 turtles (CV = 0.14, 95% CI: 209-363) [equivalent to 49 adults], 218 of which were loggerheads [equivalent to 37 adults]. After the implementation of chain mats, the average annual number of observable interactions was estimated to be 20 hard-shelled sea turtles (CV = 0.48, 95% CI: 3-42), 19 of which were loggerheads. If the rate of observable interactions from dredges without chain mats had been applied to trips with chain mats, the estimated number of observable and inferred interactions of hard-shelled sea turtles after chain mats were implemented would have been 125 turtles per year (CV = 0.15, 95% CI: 88-163) [equivalent to 22 adults], 95 of which were loggerheads [equivalent to 16 adults]. Interaction rates of hard-shelled turtles were correlated with sea surface temperature, depth, and use of a chain mat. Results from this recent analysis suggest that chain mats and fishing effort reductions have contributed to the decline in estimated loggerhead sea turtle interactions with scallop dredge gear after 2006 (Murray 2011).

An estimate of the number of loggerheads taken annually in U.S. Mid-Atlantic gillnet fisheries has also recently been published (Murray 2009a, b). From 1995-2006, the annual bycatch of loggerheads in U.S. Mid-Atlantic gillnet gear was estimated to average 350 turtles (CV=0.20, 95% CI over the 12-year period: 234 to 504). Bycatch rates were correlated with latitude, sea surface temperature, and mesh size. The highest predicted bycatch rates occurred in warm waters of the southern Mid-Atlantic in large-mesh gillnets (Murray 2009a).

The U.S. tuna and swordfish longline fisheries that are managed under the Highly Migratory Species (HMS) FMP are estimated to capture 1,905 loggerheads (no more than 339 mortalities) for each 3-year period starting in 2007 (NMFS 2004a). NMFS has mandated gear changes for the HMS fishery to reduce sea turtle bycatch and the likelihood of death from those incidental takes that would still occur (Garrison and Stokes 2010). In 2010, there were 40 observed interactions between loggerhead sea turtles and longline gear used in the HMS fishery (Garrison and Stokes 2011a, 2011b). All of the loggerheads were released alive, with the vast majority released with all gear removed. While 2010 total estimates are not yet available, in 2009, 242.9 (95% CI: 167.9-351.2) loggerhead sea turtles are estimated to have been taken in the longline fisheries managed under the HMS FMP based on the observed takes (Garrison and Stokes 2010). The 2009 estimate is considerably lower than those in 2006 and 2007 and is consistent with historical averages since 2001 (Garrison and Stokes 2010). This fishery represents just one of several longline fisheries operating in the Atlantic Ocean. Lewison *et al.* (2004) estimated that 150,000-200,000 loggerheads were taken in all Atlantic longline fisheries in 2000 (including the U.S. Atlantic tuna and swordfish longline fisheries as well as others).

Documented takes also occur in other fishery gear types and by non-fishery mortality sources (*e.g.*, hopper dredges, power plants, vessel collisions), but quantitative estimates are unavailable.

The most recent Recovery Plan for loggerhead sea turtles as well as the 2009 Status Review Report identifies global climate change as a threat to loggerhead sea turtles. However, trying to assess the likely effects of climate change on loggerhead sea turtles is extremely difficult given the uncertainty in all climate change models and the difficulty in determining the likely rate of temperature increases and the scope and scale of any accompanying habitat effects. Additionally, no significant climate change-related impacts to loggerhead sea turtle populations have been observed to date. Over the long-term, climate change related impacts are expected to influence biological trajectories on a century scale (Parmesan and Yohe 2003). As noted in the 2009 Status Review (Conant *et al*. 2009), impacts from global climate change induced by human activities are likely to become more apparent in future years (Intergovernmental Panel on Climate Change (IPCC) 2007). Climate change related increasing temperatures, sea level rise, changes in ocean productivity, and increased frequency of storm events may affect loggerhead sea turtles.

Increasing temperatures are expected to result in rising sea levels (Titus and Narayanan 1995 in Conant *et al*. 2009), which could result in increased erosion rates along nesting beaches. Sea level rise could result in the inundation of nesting sites and decrease available nesting habitat (Daniels *et al*. 1993; Fish *et al*. 2005; Baker *et al*. 2006). The BRT noted that 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; both in Conant *et al*. 2009). Along developed coastlines, and especially in areas where erosion control structures have been constructed to limit shoreline movement, rising sea levels may cause severe effects on nesting females and their eggs as nesting females may deposit eggs seaward of the erosion control structures potentially subjecting them to repeated tidal inundation. However, if global temperatures increase and there is a range shift northwards, beaches not currently used for nesting may become available for loggerhead sea turtles, which may offset some loss of accessibility to beaches in the southern portions of the range.

Climate change has the potential to result in changes at nesting beaches that may affect loggerhead sex ratios. Loggerhead sea turtles exhibit temperature-dependent sex determination. Rapidly increasing global temperatures may result in warmer incubation temperatures and highly female-biased sex ratios (*e.g.*, Glen and Mrosovsky 2004; Hawkes *et al*. 2009); however, to the extent that nesting can occur at beaches further north where sand temperatures are not as warm, these effects may be partially offset. The BRT specifically identified climate change as a threat to loggerhead sea turtles in the neritic/oceanic zone where climate change may result in future trophic changes, thus impacting loggerhead prey abundance and/or distribution. In the threats matrix analysis, climate change was considered for oceanic juveniles and adults and eggs/hatchlings. The report states that for oceanic juveniles and adults, "although the effect of trophic level change from…climate change…is unknown it is believed to be very low." For eggs/hatchlings the report states that total mortality from anthropogenic causes, including sea level rise resulting from climate change, is believed to be low relative to the entire life stage. However, only limited data are available on past trends related to climate effects on loggerhead sea turtles; current scientific methods are not able to reliably predict the future magnitude of climate change, associated impacts, whether and to what extent some impacts will offset others, or the adaptive capacity of this species.

However, Van Houtan and Halley (2011) recently developed climate based models to investigate loggerhead nesting (considering juvenile recruitment and breeding remigration) in the North Pacific and Northwest Atlantic. These models found that climate conditions/oceanographic influences explain loggerhead nesting variability, with climate models alone explaining an average 60% (range 18%-88%) of the observed nesting changes over the past several decades. In terms of future nesting projections, modeled climate data show a future positive trend for Florida nesting, with increases through 2040 as a result of the Atlantic Multidecadal Oscillation signal.

While there is a reasonable degree of certainty that certain climate change related effects will be experienced globally (*e.g.*, rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects to sea turtles resulting from climate change are not predictable or quantifiable at this time (Hawkes *et al*. 2009). However, given this uncertainty and the likely rate of change associated with climate impacts (i.e., the century scale), it is unlikely that climate related impacts will have a significant effect on the status of loggerhead sea turtles over the temporal scale of the proposed action (*i.e.*, through April 2029).

Summary of Status for Loggerhead Sea Turtles

Loggerheads are a long-lived species and reach sexual maturity relatively late at around 32-35 years in the Northwest Atlantic (NMFS and USFWS 2008). The species continues to be affected by many factors occurring on nesting beaches and in the water. These include poaching, habitat loss, and nesting predation that affects eggs, hatchlings, and nesting females on land, as well as fishery interactions, vessel interactions, marine pollution, and non-fishery (*e.g*., dredging) operations affecting all sexes and age classes in the water (NRC 1990; NMFS and USFWS 2007a, 2008). As a result, loggerheads still face many of the original threats that were the cause of their listing under the ESA.

As mentioned previously, a final revised recovery plan for loggerhead sea turtles in the Northwest Atlantic was recently published by NMFS and FWS in December 2008. The revised recovery plan is significant in that it identifies five unique recovery units, which comprise the population of loggerheads in the Northwest Atlantic, and describes specific recovery criteria for each recovery unit. The recovery plan noted a decline in annual nest counts for three of the five recovery units for loggerheads in the Northwest Atlantic, including the PFRU, which is the largest (in terms of number of nests laid) in the Atlantic Ocean. The nesting trends for the other two recovery units could not be determined due to an absence of long term data.

NMFS convened a new Loggerhead Turtle Expert Working Group (TEWG) to review all available information on Atlantic loggerheads in order to evaluate the status of this species in the Atlantic. A final report from the Loggerhead TEWG was published in July 2009. In this report, the TEWG indicated that it could not determine whether the decreasing annual numbers of nests among the Northwest Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of adult females, decreasing numbers of adult females, or a combination of these factors. Many factors are responsible for past or present loggerhead mortality that could impact current nest numbers; however, no single mortality factor stands out as a likely primary factor. It is likely that several factors compound to create the current decline, including incidental capture (in fisheries, power plant intakes, and dredging operations), lower adult female survival rates, increases in the proportion of first-time nesters, continued directed harvest, and increases in mortality due to disease. Regardless, the TEWG stated that “it is clear that the current levels of hatchling output will result in depressed recruitment to subsequent life stages over the coming decades" (TEWG 2009). However, the report does not provide information on the rate or amount of expected decrease in recruitment but goes on to state that the ability to assess the current status of loggerhead subpopulations is limited due to a lack of fundamental life history information and specific census and mortality data.

While several documents reported the decline in nesting numbers in the NWA DPS (NMFS and USFWS 2008, TEWG 2009), when nest counts through 2010 are analyzed, the nesting trends from 1989-2010 are not significantly different than zero for all recovery units within the NWA DPS for which there are enough data to analyze (76 FR 58868, September 22, 2011). The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. Based on the reviews of nesting data, as well as information on population abundance and trends, NMFS and USFWS determined in the September 2011 listing rule that the NWA DPS should be listed as threatened. They found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats.

Kemp's ridley sea turtles

Distribution and Life History

The Kemp's ridley is one of the least abundant of the world's sea turtle species. In contrast to loggerhead, leatherback, and green sea turtles, which are found in multiple oceans of the world, Kemp's ridleys typically occur only in the Gulf of Mexico and the northwestern Atlantic Ocean (NMFS et al. 2011).

Kemp's ridleys mature at 10-17 years (Caillouet *et al.* 1995; Schmid and Witzell 1997; Snover *et al.* 2007; NMFS and USFWS 2007c). Nesting occurs from April through July each year with hatchlings emerging after 45-58 days (NMFS et al. 2011). Females lay an average of 2.5 clutches within a season (TEWG 1998, 2000) and the mean remigration interval for adult females is 2 years (Marquez *et al*. 1982; TEWG 1998, 2000).

Once they leave the nesting beach, hatchlings presumably enter the Gulf of Mexico where they feed on available S*argassum* and associated infauna or other epipelagic species (NMFS et al. 2011). The presence of juvenile turtles along both the U.S. Atlantic and Gulf of Mexico coasts, where they are recruited to the coastal benthic environment, indicates that post-hatchlings are distributed in both the Gulf of Mexico and Atlantic Ocean (TEWG 2000).

The location and size classes of dead turtles recovered by the STSSN suggests that benthic immature developmental areas occur along the U.S. coast and that these areas may change given resource quality and quantity (TEWG 2000). Developmental habitats are defined by several characteristics, including coastal areas sheltered from high winds and waves such as embayments and estuaries, and nearshore temperate waters shallower than 50 m (NMFS and USFWS 2007c). The suitability of these habitats depends on resource availability, with optimal environments providing rich sources of crabs and other invertebrates. Kemp's ridleys consume a variety of crab species, including *Callinectes*, *Ovalipes*, *Libinia*, and *Cancer* species. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). A wide variety of substrates have been documented to provide good foraging habitat, including seagrass beds, oyster reefs, sandy and mud bottoms, and rock outcroppings (NMFS and USFWS 2007c).

Foraging areas documented along the U.S. Atlantic coast include Charleston Harbor, Pamlico Sound (Epperly *et al.* 1995c), Chesapeake Bay (Musick and Limpus 1997), Delaware Bay (Stetzar 2002), and Long Island Sound (Morreale and Standora 1993; Morreale *et al*. 2005). For instance, in the Chesapeake Bay, Kemp's ridleys frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp's ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Epperly *et al.* 1995a, 1995b; Musick and Limpus 1997).

Adult Kemp's ridleys are found in the coastal regions of the Gulf of Mexico and southeastern United States, but are typically rare in the northeastern U.S. waters of the Atlantic (TEWG 2000). Adults are primarily found in nearshore waters of 37 m or less that are rich in crabs and have a sandy or muddy bottom (NMFS and USFWS 2007c).

Population Dynamics and Status

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS and USFWS 2007c; NMFS et al. 2011). There is a limited amount of scattered nesting to the north and south of the primary nesting beach (NMFS and USFWS 2007c). Nesting often occurs in synchronized emergences termed *arribadas*. The number of recorded nests reached an estimated low of 702 nests in 1985, corresponding to fewer than 300 adult females nesting in that season (TEWG 2000; NMFS and USFWS 2007c; NMFS et al. 2011). Conservation efforts by Mexican and U.S. agencies have aided this species by eliminating egg harvest, protecting eggs and hatchlings, and reducing at-sea mortality through fishing regulations (TEWG 2000). Since the mid-1980s, the number of nests observed at Rancho Nuevo and nearby beaches has increased 14-16% per year (Heppell *et al.* 2005), allowing cautious optimism that the population is on its way to recovery. An estimated 5,500 females nested in the State of Tamaulipas over a 3-day period in May 2007 and over 4,000 of those nested at Rancho Nuevo (NMFS and USFWS 2007c). In 2008, 17,882 nests were documented on Mexican nesting beaches (NMFS 2011). There is limited nesting in the United States, most of which is located in South Texas. While six nests were documented in 1996, a record 195 nests were found in 2008 (NMFS 2011).

Threats

Kemp's ridleys face many of the same natural threats as loggerheads, including destruction of nesting habitat from storm events, predators, and oceanographic-related events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. In the last five years (2006-2010), the number of cold-stunned turtles on Cape Cod beaches averaged 115 Kemp's ridleys, 7 loggerheads, and 7 greens (NMFS unpublished data). The numbers ranged from a low in 2007 of 27 Kemp's ridleys, 5 loggerheads, and 5 greens to a high in 2010 of 213 Kemp's ridleys, 4 loggerheads, and 14 greens. Annual cold stun events vary in magnitude; the extent of episodic major cold stun events may be associated with numbers of turtles utilizing Northeast U.S. waters in a given year, oceanographic conditions, and/or the occurrence of storm events in the late fall. Although many cold-stunned turtles can survive if they are found early enough, these events represent a significant source of natural mortality for Kemp's ridleys.

Like other sea turtle species, the severe decline in the Kemp's ridley population appears to have been heavily influenced by a combination of exploitation of eggs and impacts from fishery interactions. From the 1940s through the early 1960s, nests from Ranch Nuevo were heavily exploited, but beach protection in 1967 helped to curtail this activity (NMFS et al. 2011). Following World War II, there was a substantial increase in the number of trawl vessels, particularly shrimp trawlers, in the Gulf of Mexico where adult Kemp's ridley sea turtles occur. Information from fisheries observers helped to demonstrate the high number of turtles taken in these shrimp trawls (USFWS and NMFS 1992). Subsequently, NMFS has worked with the industry to reduce sea turtle takes in shrimp trawls and other trawl fisheries, including the development and use of turtle excluder devices (TEDs). As described above, there is lengthy regulatory history with regard to the use of TEDs in the U.S. South Atlantic and Gulf of Mexico shrimp fisheries (NMFS 2002a; Epperly 2003; Lewison *et al.* 2003). The 2002 Biological Opinion on shrimp trawling in the southeastern United States concluded that 155,503 Kemp's ridley sea turtles would be taken annually in the fishery with 4,208 of the takes resulting in mortality (NMFS 2002a).

Although modifications to shrimp trawls have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impact (fishery and non-fishery related), similar to those discussed above. Three Kemp's ridley captures in Mid-Atlantic trawl fisheries were documented by NMFS observers between 1994 and 2008 (Warden and Bisack 2010), and eight Kemp's ridleys were documented by NMFS observers in mid-Atlantic sink gillnet fisheries between 1995 and 2006 (Murray 2009a). Additionally, in the spring of 2000, a total of five Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. The cause of death for most of the turtles recovered was unknown, but the mass mortality event was suspected by NMFS to have been from a large-mesh gillnet fishery for monkfish and dogfish operating offshore in the preceding weeks (67 FR 71895, December 3, 2002). The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction, since it is unlikely that all of the carcasses washed ashore. The NMFS Northeast Fisheries Science Center also documented 14 Kemp's ridleys entangled in or impinged on Virginia pound net leaders from 2002-2005. Note that bycatch estimates for Kemp's ridleys in various fishing gear types (*e.g.*, trawl, gillnet, dredge) are not available at this time, largely due to the low number of observed interactions precluding a robust estimate.

The recovery plan for Kemp's ridley sea turtles (NMFS et al. 2011) identifies climate change as a threat; however, as with the other species discussed above, no significant climate change-related impacts to Kemp's ridley sea turtles have been observed to date. Atmospheric warming could cause habitat alteration which may change food resources such as crabs and other invertebrates. It may increase hurricane activity, leading to an increase in debris in nearshore and offshore waters, which may result in an increase in entanglement, ingestion, or drowning. In addition, increased hurricane activity may cause damage to nesting beaches or inundate nests with sea water. Atmospheric warming may change convergence zones, currents and other oceanographic features that are relevant to Kemp's ridleys, as well as change rain regimes and levels of nearshore runoff.

Considering that the Kemp's ridley has temperature-dependent sex determination (Wibbels 2003) and the vast majority of the nesting range is restricted to the State of Tamaulipas, Mexico, global warming could potentially shift population sex ratios towards females and thus change the reproductive ecology of this species. A female bias is presumed to increase egg production (assuming that the availability of males does not become a limiting factor) (Coyne and Landry 2007) and increase the rate of recovery; however, it is unknown at what point the percentage of males may become insufficient to facilitate maximum fertilization rates in a population. If males become a limiting factor in the reproductive ecology of the Kemp's ridley, then reproductive output in the population could decrease (Coyne 2000). Low numbers of males could also result in the loss of genetic diversity within a population; however, there is currently no evidence that this is a problem in the Kemp's ridley population (NMFS et al. 2011). Models (Davenport 1997, Hulin and Guillon 2007, Hawkes *et al*. 2007, all referenced in NMFS et al. 2011) predict very long-term reductions in fertility in sea turtles due to climate change, but due to the relatively long life cycle of sea turtles, reductions may not be seen until 30 to 50 years in the future.

Another potential impact from global climate change is sea level rise, which may result in increased beach erosion at nesting sites. Beach erosion may 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. In the case of the Kemp's ridley where most of the critical nesting beaches are undeveloped, beaches may shift landward and still be available for nesting. The Padre Island National Seashore (PAIS) shoreline is accreting, unlike much of the Texas coast, and with nesting increasing and the sand temperatures slightly cooler than at Rancho Nuevo, PAIS could become an increasingly important source of males for the population.

As with the other sea turtle species discussed in this section, while there is a reasonable degree of certainty that certain climate change related effects will be experienced globally (*e.g.*, rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects of climate change on this species are not predictable or quantifiable at this time (Hawkes *et al*. 2009). However, given the likely rate of change associated with climate impacts (*i.e.*, the century scale), it is unlikely that climate change will have a significant effect on the status of Kemp's ridley sea turtles over the temporal scale of the proposed action (*i.e.*, through April 2029).

Summary of Status for Kemp's Ridley Sea Turtles

The majority of Kemp's ridleys nest along a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; NMFS and USFWS 2007c; NMFS et al. 2011). The number of nesting females in the Kemp's ridley population declined dramatically from the late 1940s through the mid-1980s, with an estimated 40,000 nesting females in a single *arribada* in 1947 and fewer than 300 nesting females in the entire 1985 nesting season (TEWG 2000; NMFS et al. 2011). However, the total annual number of nests at Rancho Nuevo gradually began to increase in the 1990s (NMFS and USFWS 2007c). Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles (1.8-2 years), there were an estimated 7,000-8,000 adult female Kemp's ridley sea turtles in 2006 (NMFS and USFWS 2007c). The number of adult males in the population is unknown, but sex ratios of hatchlings and immature Kemp's ridleys suggest that the population is female-biased, suggesting that the number of adult males is less than the number of adult females (NMFS and USFWS 2007c). While there is cautious optimism for recovery, events such as the Deepwater Horizon oil release, and stranding events associated skimmer trawl use and poor TED compliance in the northern Gulf of Mexico may dampen recent population growth.

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like dredging, pollution, and habitat destruction account for an unknown level of other mortality. Based on their 5-year status review of the species, NMFS and USFWS (2007c) determined that Kemp's ridley sea turtles should not be reclassified as threatened under the ESA. A revised bi-national recovery plan was published for public comment in 2010, and in September 2011, NMFS, USFWS, and the Services and the Secretary of Environment and Natural Resources, Mexico (SEMARNAT) released the second revision to the Kemp's ridley recovery plan.

Green sea turtles

Green sea turtles are distributed circumglobally, and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991, 2007d; Seminoff 2004). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered. As it is difficult to differentiate between breeding populations away from the nesting beaches, all green sea turtles in the water are considered endangered.

Pacific Ocean

Green sea turtles occur in the western, central, and eastern Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998b). In the western Pacific, major nesting rookeries at four sites including Heron Island (Australia), Raine Island (Australia), Guam, and Japan were evaluated and determined to be increasing in abundance, with the exception of Guam which appears stable (NMFS and USFWS 2007d). In the central Pacific, nesting occurs on French Frigate Shoals, Hawaii, which has also been reported as increasing with a mean of 400 nesting females annually from 2002-2006 (NMFS and USFWS 2007d). The main nesting sites for the green sea turtle in the eastern Pacific are located in Michoacan, Mexico and in the Galapagos Islands, Ecuador (NMFS and USFWS 2007d). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007d). However, historically, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). The Pacific Mexico green turtle nesting population (also called the black turtle) is considered endangered.

Historically, green sea turtles were used in many areas of the Pacific for food. They were also commercially exploited, which, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998b). Green sea turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis, which is a viral disease that causes tumors in affected turtles (NMFS and USFWS 1998b; NMFS 2004b).

Indian Ocean

There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997; Ferreira *et al.* 2003). Based on a review of the 32 Index Sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green sea turtle nesting were evident for many of the Indian Ocean Index Sites. While several of these had not demonstrated further declines in the more recent past, only the Comoros Island Index Site in the western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

Mediterranean Sea

There are four nesting concentrations of green sea turtles in the Mediterranean from which data are available – Turkey, Cyprus, Israel, and Syria. Currently, approximately 300-400 females nest each year, about two-thirds of which nest in Turkey and one-third in Cyprus. Although green sea turtles are depleted from historic levels in the Mediterranean Sea (Kasparek *et al.* 2001), nesting data gathered since the early 1990s in Turkey, Cyprus, and Israel show no apparent trend in any direction. However, a declining trend is apparent along the coast of Palestine/Israel, where 300-350 nests were deposited each year in the 1950s (Sella 1982) compared to a mean of 6 nests per year from 1993-2004 (Kuller 1999; Y. Levy, Israeli Sea Turtle Rescue Center, unpublished data). A recent discovery of green sea turtle nesting in Syria adds roughly 100 nests per year to green sea turtle nesting activity in the Mediterranean (Rees *et al.* 2005). That such a major nesting concentration could have gone unnoticed until recently (the Syria coast was surveyed in 1991, but nesting activity was attributed to loggerheads) bodes well for the ongoing speculation that the unsurveyed coast of Libya may also host substantial nesting.

Atlantic Ocean

<u>Distribution and Life History</u>

As has occurred in other oceans of its range, green sea turtles were once the target of directed fisheries in the United States and throughout the Caribbean. In 1890, over one million pounds of green sea turtles were taken in a directed fishery in the Gulf of Mexico (Doughty 1984). However, declines in the turtle fishery throughout the Gulf of Mexico were evident by 1902 (Doughty 1984).

In the western Atlantic, large juvenile and adult green sea turtles are largely herbivorous, occurring in habitats containing benthic algae and seagrasses from Massachusetts to Argentina, including the Gulf of Mexico and Caribbean (Wynne and Schwartz 1999). Green sea turtles occur seasonally in Mid-Atlantic and Northeast waters such as Chesapeake Bay and Long Island Sound (Musick and Limpus 1997; Morreale and Standora 1998; Morreale *et al.* 2005), which serve as foraging and developmental habitats.

Some of the principal feeding areas in the western Atlantic Ocean include the upper west coast of Florida, the Florida Keys, and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Mosquito Coast of Nicaragua, the Caribbean coast of Panama, and scattered areas along Colombia and Brazil (Hirth 1971). The waters surrounding the island of Culebra, Puerto Rico, and its outlying keys are designated critical habitat for the green sea turtle.

Age at maturity for green sea turtles is estimated to be 20-50 years (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004). As is the case with the other sea turtle species described above, adult females may nest multiple times in a season (average 3 nests/season with approximately 100 eggs/nest) and typically do not nest in successive years (NMFS and USFWS 1991; Hirth 1997).

Population Dynamics and Status

Like other sea turtle species, nest count information for green sea turtles provides information on the relative abundance of nesting, and the contribution of each nesting group to total nesting of the species. Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 5-year status review for the species identified eight geographic areas considered to be primary sites for threatened green sea turtle nesting in the Atlantic/Caribbean, and reviewed the trend in nest count data for each (NMFS and USFWS 2007d). These 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 Achipelago, Guinea-Bissau (NMFS and USFWS 2007d). Nesting at all of these sites is considered to be stable or increasing with the exception of Bioko Island, which may be declining. However, the lack of sufficient data precludes a meaningful trend assessment for this site (NMFS and USFWS 2007d).

Seminoff (2004) reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above threatened nesting sites with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. He 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 Ocean. 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 2007d).

By far, the most important nesting concentration for green sea turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007d). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007d). The number of females nesting per year on beaches in the Yucatán, at Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007d).

The status of the endangered Florida breeding population was also evaluated in the 5-year review (NMFS and USFWS 2007d). The pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally positive trend since establishment of the Florida index beach surveys in 1989. This trend is perhaps due to increased protective legislation throughout the Caribbean (Meylan *et al.* 1995), as well as protections in Florida and throughout the United States (NMFS and USFWS 2007d).

The statewide Florida surveys (2000-2006) have shown that a mean of approximately 5,600 nests are laid annually in Florida, with a low of 581 in 2001 to a high of 9,644 in 2005 (NMFS and USFWS 2007d). Most nesting occurs along the east coast of Florida, but occasional nesting has been documented along the Gulf coast of Florida, at Southwest Florida beaches, as well as the beaches in the Florida Panhandle (Meylan *et al.* 1995). More recently, green sea turtle nesting occurred on Bald Head Island, North Carolina (just east of the mouth of the Cape Fear River), Onslow Island, and Cape Hatteras National Seashore. One green sea turtle nested on a beach in Delaware in 2011, although its occurrence was considered very rare.

<u>Threats</u>

Green sea turtles face many of the same natural threats as loggerhead and Kemp's ridley sea turtles. In addition, green sea turtles appear to be particularly susceptible to fibropapillomatosis, an epizootic disease producing lobe-shaped tumors on the soft portion of a turtle's body. Juveniles appear to be most affected in that they have the highest incidence of disease and the most extensive lesions, whereas lesions in nesting adults are rare. Also, green sea turtles frequenting nearshore waters, areas adjacent to large human populations, and areas with low water turnover, such as lagoons, have a higher incidence of the disease than individuals in deeper, more remote waters. The occurrence of fibropapilloma tumors may result in impaired foraging, breathing, or swimming ability, leading potentially to death (George 1997).

As with the other sea turtle species, incidental fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches. Witherington *et al*. (2009) observes that because green sea turtles spend a shorter time in oceanic waters and as older juveniles occur on shallow seagrass pastures (where benthic trawling is unlikely), they avoid high mortalities in pelagic longline and benthic trawl fisheries. Although the relatively low number of observed green sea turtle captures makes it difficult to estimate bycatch rates and annual take levels, green sea turtles have been observed captured in the pelagic driftnet, pelagic longline, southeast shrimp trawl, and mid-Atlantic trawl and gillnet fisheries. Murray (2009a) also lists five observed captures of green turtle in Mid-Atlantic sink gillnet gear between 1995 and 2006. Other activities like channel dredging, marine debris, pollution, vessel strikes, power plant impingement, and habitat destruction account for an unquantifiable level of other mortality. Stranding reports indicate that between 200-400 green sea turtles strand annually along the eastern U.S. coast from a variety of causes most of which are unknown (STSSN database).

The five year status review for green sea turtles (NMFS and USFWS 2007d) notes that global climate change is affecting green sea turtles and is likely to continue to be a threat. There is an increasing female bias in the sex ratio of green turtle hatchlings. While this is partly attributable to imperfect egg hatchery practices, global climate change is also implicated as a likely cause as warmer sand temperatures at nesting beaches are likely to result in the production of more female embryos. At least one nesting site, Ascension Island, has had an increase in mean sand temperature in recent years (Hays *et al*. 2003 in NMFS and USFWS 2007d). Climate change may also impact nesting beaches through sea level rise which may reduce the availability of nesting habitat and increase the risk of nest inundation. Loss of appropriate nesting habitat may also be accelerated by 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. Oceanic changes related to rising water temperatures could result in changes in the abundance and distribution of the primary food sources of green sea turtles, which in turn could result in changes in behavior and distribution of this species. Seagrass habitats may suffer from decreased productivity and/or increased stress due to sea level rise, as well as salinity and temperature changes (Short and Neckles 1999; Duarte 2002).

As noted above, the increasing female bias in green sea turtle hatchlings is thought to be at least partially linked to increases in temperatures at nesting beaches. However, due to a lack of scientific data, the specific future effects of climate change on green sea turtles species are not predictable or quantifiable to any degree at this time (Hawkes *et al*. 2009). For example, information is not available to predict the extent and rate to which sand temperatures at the nesting beaches used by green sea turtles may increase over the temporal scale of the proposed action (*i.e.*, through April 2029) and the extent to which green sea turtles may be able to cope with this change by selecting cooler areas of the beach or shifting their nesting distribution to other beaches at which increases in sand temperature may not be experienced.

Summary of Status of Green Sea Turtles

A review of 32 Index Sites[2] distributed globally revealed a 48-67% decline in the number of mature females nesting annually over the last three generations[3] (Seminoff 2004). An evaluation of green sea turtle nesting sites was also conducted as part of the 5-year status review of the species (NMFS and USFWS 2007d). Of the 23 threatened nesting groups assessed in that report

[2] The 32 Index Sites include all of the major known nesting areas as well as many of the lesser nesting areas for which quantitative data are available.

[3] Generation times ranged from 35.5 years to 49.5 years for the assessment depending on the Index Beach site

for which nesting abundance trends could be determined, ten were considered to be increasing, nine were considered stable, and four were considered to be decreasing (NMFS and USFWS 2007d). Nesting groups were considered to be doing relatively well (the number of sites with increasing nesting were greater than the number of sites with decreasing nesting) in the Pacific, western Atlantic, and central Atlantic (NMFS and USFWS 2007d). However, nesting populations were determined to be doing relatively poorly in Southeast Asia, eastern Indian Ocean, and perhaps the Mediterranean. Overall, based on mean annual reproductive effort, the report estimated that 108,761 to 150,521 females nest each year among the 46 threatened and endangered nesting sites included in the evaluation (NMFS and USFWS 2007d). However, given the late age to maturity for green sea turtles, caution is urged regarding the status for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USFWS 2007d).

Seminoff (2004) and NMFS and USFWS (2007d) made comparable conclusions with regard to nesting for four nesting sites in the western Atlantic that indicate sea turtle abundance is increasing in the Atlantic Ocean. Each also concluded that nesting at Tortuguero, Costa Rica represented the most important nesting area for green sea turtles in the western Atlantic and that nesting had increased markedly since the 1970s (Seminoff 2004; NMFS and USFWS 2007d).

However, the 5-year review also noted that the Tortuguero nesting stock continued to be affected by ongoing directed take at their primary foraging area in Nicaragua (NMFS and USFWS 2007d). The endangered breeding population in Florida appears to be increasing based upon index nesting data from 1989-2010 (NMFS 2011).

As with the other sea turtle species, fishery mortality accounts for a large proportion of annual human-caused mortality outside the nesting beaches, while other activities like hopper dredging, pollution, and habitat destruction account for an unknown level of other mortality. Based on its 5-year status review of the species, NMFS and USFWS (2007d) determined that the listing classification for green sea turtles should not be changed. However, it was also determined that an analysis and review of the species should be conducted in the future to determine whether DPSs should be identified (NMFS and USFWS 2007d).

ENVIRONMENTAL BASELINE

Environmental baselines for biological opinions include the past and present impacts of all state, federal or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early Section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The environmental baseline for this Opinion includes the effects of several activities that may affect the survival and recovery of the listed species in the action area.

Federal Actions that have Undergone Formal or Early Section 7 Consultation

The only project within the action area that has been subject to formal section 7 consultation has been the operation of the OCNGS. Details of these previous consultations were noted in the

Background section (see page 1). The impact of the historical operation of the OCNGS on listed sea turtles is detailed below.

Impacts of the Historical Operation of the OCNGS

As noted above, the OCGNS was constructed in the 1960s and began generating power in 1969. No sea turtles were observed at the facility until 1992. However, between 1969 and 1992 there was no directed attempt to document sea turtles at the facility and the frequency and efficiency of monitoring the intakes prior to 1992 has not been determined. Since 1992 there have been a total of 69 recorded takes at the OCNGS (see Table 1 and Figures 1 and 2 above, Table 2 below and Appendix 1 for details).

Between June 1992 and July 1994, 9 sea turtle impingements occurred at the OCNGS intake trash bars, including 5 loggerheads (1 recapture) and 4 Kemp's ridleys. Three of the loggerheads and 1 of the Kemp's ridleys were recovered alive. The remaining turtles were recovered dead from the intake trash bars. Of the 5 dead sea turtles, 3 were necropsied. Necropsy results for 2 of the 3 sea turtles indicated that they had died prior to becoming impinged at the intakes (1 loggerhead, 1 Kemp's ridley), while the remaining turtle, a Kemp's ridley, likely drowned at the intakes. Of the 2 sea turtles that were not necropsied, 1 of them displayed signs of injury or decomposition that indicated it may have died prior to becoming impinged on the intakes.

There were no sea turtle takes observed in 1995 or 1996. One Kemp's ridley turtle was lethally taken in 1997. No necropsy was completed for this turtle; however, the lack of significant injuries or signs of decomposition indicate it likely died at the intakes. In 1998, one loggerhead was recovered alive.

Between 1999 and 2006, a total of 30 sea turtle impingements have been documented at the OCNGS intake structures. Of these 30 turtles, (22 Kemp's ridley, 4 loggerheads, and 4 green), 21 of the turtles were recovered alive. Of the 9 dead sea turtles (8 Kemp's, 1 green), necropsy results are available for 3 Kemp's ridleys. Necropsy results indicate that 1 of the turtles likely died from drowning at the intakes while the other two sea turtles were likely dead prior to becoming impinged on the intakes. Of the remaining 6 dead sea turtles, only 1 of them had wounds which indicated it may have died prior to becoming impinged at the intakes. Between 2007 and 2010, a total of 28 sea turtles were recovered from the OCNGS intake structures. Of these 28 turtles (23 Kemp's, 1 loggerhead, and 4 green), 22 were recovered alive. Of the six dead turtles, necropsy results indicate that 3 likely died by drowning at the intakes, 2 were likely dead prior to impingement and 1 had an unknown cause of death.

In summary, there have been 69 total observed sea turtles at the OCNGS intakes since 1969, including 50 Kemp's ridleys, 11 loggerheads (which includes 1 recapture), and 8 greens. These numbers include 21 dead sea turtles (18 Kemp's, 1 green, 2 loggerheads) that have been removed from the intakes at OCNGS since 1992. Based on the best available information, at least 12 (11 Kemps, 1 green) of the 21 dead sea turtles likely died from drowning or suffocation at the intakes. No cause of death was able to be identified for two of the turtles captured at OCNGS; 7 turtles likely died prior to impingement at the intakes; however, the lack of necropsy information for several of these turtles makes this conclusion somewhat speculative.

Since 1992, the number of sea turtles collected at the OCNGS intakes annually has ranged from zero (1995 and 1996) to a maximum of 11 in 2009. The number of loggerheads at OCNGS has ranged from zero to 3 (1992), the number of Kemp's ridley annual takes has been from zero to 10 (2009), and, the number of green sea turtles collected annually on the intakes ranged from zero to 3 (2010). The number of mortalities has been as high of 4 in 2009, while in most other years it has been 1 or zero (with the exception of 2004 (3 Kemp's), 2001 (2 Kemp's) and 1994 (2 Kemp's and 1 loggerhead).

The best available information indicates that the operation of OCNGS has had an effect on sea turtles in the action area. In addition to causing the death of at least 12 sea turtles since 1992, it has caused injury to nearly all the other live sea turtles captured at the facility (76 total) and has disrupted the migratory movements of these turtles. These turtles have also been subjected to the stress of removal from the water and transfer to a rehabilitation facility.

Contaminants and Water Quality

Point source discharges (i.e., municipal wastewater, industrial or power plant cooling water or waste water) and compounds associated with discharges (i.e., metals, dioxins, dissolved solids, phenols, and hydrocarbons) contribute to poor water quality and may also impact the health of sea turtle populations.

Sources of contamination in the action area include atmospheric loading of pollutants, stormwater runoff from coastal development, groundwater discharges, and industrial development. Chemical contaminants may occur in the action area largely as a result of nonpoint source pollution. The Barnegat Bay Estuary Program has data on trace metals and radionuclides in the Barnegat Bay, but other toxic chemical contaminants may also occur in the action area including halogenated hydrocarbons and polycyclic aromatic hydrocarbons (PAHs). The Barnegat Bay estuary may be more susceptible to toxic chemical contaminants than may other estuaries because of its limited dilution capacity and flushing rate (Barnegat Bay Estuary Program 2001).

While the effects of contaminants on turtles are relatively unclear, pollutants may also make sea turtles more susceptible to disease by weakening their immune systems. Chemical contaminants may also have an effect on sea turtle reproduction and survival. Pollution may also be linked to the fibropapilloma virus that kills many turtles each year (NMFS 1997). If pollution is not the causal agent, it may make sea turtles more susceptible to disease by weakening their immune systems.

Excessive turbidity due to coastal development and/or construction sites could influence sea turtle foraging ability. Turtles are not very easily affected by changes in water quality or increased suspended sediments, but if these alterations make habitat less suitable for turtles and hinder their capability to forage, eventually they would tend to leave or avoid these less desirable areas (Ruben and Morreale 1999).

Approximately 28% of the Barnegat Bay watershed is developed (residential, commercial, industrial, and institutional), while 46% is forested land. Barnegat Bay supports a thriving tourist industry, with boating, fishing, swimming, and hunting being top recreational activities. The developed land around the Bay may contribute to marine pollution which may in turn impact sea turtles. Marine debris (e.g., discarded fishing line or lines from boats) can entangle turtles in the water and drown them. Turtles commonly ingest plastic or mistake debris for food.

Private and Commercial Vessel Operations
Private and commercial vessels operate in the action area and have the potential to interact with sea turtles. An unknown number of private recreational boaters frequent coastal waters. These activities have the potential to result in lethal (through entanglement or boat strike) or non-lethal (through harassment) takes of listed species that could prevent or slow a species' recovery. *Collisions with vessels,* from both commercial and recreational sources, is a potential contributor to sea turtle mortality in the action area. Fifty to 500 loggerheads and 5 to 50 Kemp's ridley turtles are estimated to be killed by vessel traffic per year in the U.S. (National Research Council 1990). Although some of these strikes may be post-mortem, the data show that vessel traffic is a substantial cause of sea turtle mortality. The Intracoastal Waterway traverses the length of Barnegat Bay, and numerous recreational boaters and commercial fishing boats travel this waterway. The Intracoastal Waterway is maintained at a depth of approximately 2 meters by the Army Corps of Engineers, but the greatest depths in Barnegat Bay of 3 to 4 meters occur along this area. Vessel traffic occurs in the action area, specifically in the thermal plume region that extends from Oyster Creek into Barnegat Bay. As turtles may be in the area where high vessel traffic occurs, the potential exists for collisions with vessels transiting from within the action area into the main waters of Barnegat Bay. At least 3 of the sea turtles impinged at OCNGS likely died due to injuries sustained from propeller wounds and/or a boat strike prior to becoming impinged. As these wounds were relatively fresh, they were likely sustained within the action area. Several other sea turtles had scars indicative of past interactions with boats or propellers; it is impossible to determine whether these interactions occurred within the action area.

Non-Federally Regulated Fishery Operations
Very little is known about the level of interactions with listed species in fisheries that operate strictly in state waters. However, depending on the fishery in question, many state permit holders also hold federal licenses; therefore, section 7 consultations on federal actions in those fisheries address some state-water activity. Impacts on sea turtles from state fisheries may be greater than those from federal activities in certain areas due to the distribution of these species. Nearshore entanglements of turtles have been documented; however, information is not currently available on whether the vessels involved were permitted by the state or by NMFS. NMFS is actively participating in a cooperative effort with the Atlantic States Marine Fisheries Commission (ASMFC) and member states to standardize and/or implement programs to collect information on level of effort and bycatch of protected species in state fisheries. When this information becomes available, it can be used to refine take reduction plan measures in state waters.

A variety of commercial and recreational fisheries occur in the action area. Commercially important finfish and shellfish species occurring in the Barnegat Bay include the American eel, alewife, bluefish, striped bass, summer flounder, winter flounder, weakfish, blue crab, horseshoe crab, and hard clam (Barnegat Bay Estuary Program 2001). Several recreational fisheries exist in the action area as well, most notably for bluefish, striped bass, summer flounder, winter flounder, weakfish, black sea bass, and tautog. Fishing gear has been found to entangle and/or hook sea turtles, which can lead to mortality if the sea turtle cannot surface for air. Throughout their range, sea turtles have been taken in different types of gear, including gillnet, pound net, rod and reel, trawl, pot and trap, longline, and dredge gear. There have been no documented takes of sea turtles in any of the fisheries in Barnegat Bay, but it is not known to what degree the various fisheries interact with turtles. For example, one of the sea turtles impinged at OCNGS had 12 feet of line wrapped around its flipper and was trailing a plastic bucket tied to this line. It is not known whether this line and bucket were related to fishing operations in the action area. However, it is likely that sea turtles in the action area interact and are affected by commercial or recreational fisheries operating in the action area.

Global climate change

The global mean temperature has risen 0.76ºC over the last 150 years, and the linear trend over the last 50 years is nearly twice that for the last 100 years (IPCC 2007a) and precipitation has increased nationally by 5%-10%, mostly due to an increase in heavy downpours (NAST 2000). There is a high confidence, based on substantial new evidence, that observed changes in marine systems are associated with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels, and circulation. Ocean acidification resulting from massive amounts of carbon dioxide and pollutants released into the air can have major adverse impacts on the calcium balance in the oceans. Changes to the marine ecosystem due to climate change include shifts in ranges and changes in algal, plankton, and fish abundance (IPCC 2007b).
These trends are most apparent over the past few decades.

Climate model projections exhibit a wide range of plausible scenarios for both temperature and precipitation over the next century. Both of the principal climate models used by the National Assessment Synthesis Team (NAST) project warming in the southeast by the 2090s, but at different rates (NAST 2000): the Canadian model scenario shows the southeast U.S. experiencing a high degree of warming, which translates into lower soil moisture as higher temperatures increase evaporation; the Hadley model scenario projects less warming and a significant increase in precipitation (about 20%). The scenarios examined, which assume no major interventions to reduce continued growth of world greenhouse gases (GHG), indicate that temperatures in the U.S. will rise by about 3^o-5^oC (5^o-9^oF) on average in the next 100 years which is more than the projected global increase (NAST 2000). A warming of about 0.2^oC per decade is projected for the next two decades over a range of emission scenarios (IPCC 2007). This temperature increase will very likely be associated with more extreme precipitation and faster evaporation of water, leading to greater frequency of both very wet and very dry conditions. Climate warming has resulted in increased precipitation, river discharge, and glacial and sea-ice melting (Greene et al. 2008).

The past 3 decades have witnessed major changes in ocean circulation patterns in the Arctic, and these were accompanied by climate associated changes as well (Greene et al. 2008). Shifts in atmospheric conditions have altered Arctic Ocean circulation patterns and the export of freshwater to the North Atlantic (Greene et al. 2008, IPCC 2006). With respect specifically to the North Atlantic Oscillation (NAO), changes in salinity and temperature are thought to be the result of changes in the earth's atmosphere caused by anthropogenic forces (IPCC 2006). The NAO impacts climate variability throughout the northern hemisphere (IPCC 2006). Data from the 1960s through the present show that the NAO index has increased from minimum values in the 1960s to strongly positive index values in the 1990s and somewhat declined since (IPCC 2006). This warming extends over 1000m deep and is deeper than anywhere in the world oceans and is particularly evident under the Gulf Stream/ North Atlantic Current system (IPCC 2006). On a global scale, large discharges of freshwater into the North Atlantic subarctic seas can lead to intense stratification of the upper water column and a disruption of North Atlantic Deepwater (NADW) formation (Greene et al. 2008, IPCC 2006). There is evidence that the NADW has already freshened significantly (IPCC 2006). This is turn can lead to a slowing down of the global ocean thermohaline (large-scale circulation in the ocean that transforms low-density upper ocean waters to higher density intermediate and deep waters and returns those waters back to the upper ocean), which can have climatic ramifications for the whole earth system (Greene et al. 2008).

While predictions are available regarding potential effects of climate change globally, it is more difficult to assess the potential effects of climate change over the next few decades on coastal and marine resources on smaller geographic scales, such as Barnegat Bay generally and the action area specifically, especially as climate variability is a dominant factor in shaping coastal and marine systems. The effects of future change will vary greatly in diverse coastal regions for the United States. Additional information on potential effects of climate change specific to the action area is discussed below. Warming is very likely to continue in the U.S. during the next 25 to 50 years regardless of reduction in GHGs, due to emissions that have already occurred (NAST 2000). It is very likely that the magnitude and frequency of ecosystem changes will continue to increase in the next 25 to 50 years, and it is possible that they will accelerate. Climate change can cause or exacerbate direct stress on ecosystems through high temperatures, a reduction in water availability, and altered frequency of extreme events and severe storms. Water temperatures in streams and rivers are likely to increase as the climate warms and are very likely to have both direct and indirect effects on aquatic ecosystems. Changes in temperature will be most evident during low flow periods when they are of greatest concern (NAST 2000). In some marine and freshwater systems, shifts in geographic ranges and changes in algal, plankton, and fish abundance are associated with high confidence with rising water temperatures, as well as related changes in ice cover, salinity, oxygen levels and circulation (IPCC 2007).

A warmer and drier climate is expected to result in reductions in stream flows and increases in water temperatures. Expected consequences could be a decrease in the amount of dissolved oxygen in surface waters and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing rate (Murdoch et al. 2000). Because many rivers are already under a great deal of stress due to excessive water withdrawal or land development, and this stress may be exacerbated by changes in climate, anticipating and planning adaptive strategies may be critical (Hulme 2005). A warmer-wetter climate could ameliorate poor water quality conditions in places where human-caused concentrations of nutrients and pollutants currently degrade water quality (Murdoch et al. 2000). Increases in water temperature and changes in seasonal patterns of runoff will very likely disturb fish habitat and affect recreational uses of lakes, streams, and wetlands. Surface water resources in the southeast are intensively managed with dams and channels and almost all are affected by human activities; in some systems water quality is either below recommended levels or nearly so. A global analysis of the potential effects of climate change on river basins indicates that due to changes in discharge and water stress, the area of large river basins in need of reactive or proactive management interventions in response to climate change will be much higher for basins impacted by dams than for basins with free-flowing rivers (Palmer et al. 2008). Human-induced disturbances also influence coastal and marine systems, often reducing the ability of the systems to adapt so that systems that might ordinarily be capable of responding to variability and change are less able to do so. Because stresses on water quality are associated with many activities, the impacts of the existing stresses are likely to be exacerbated by climate change. Within 50 years, river basins that are impacted by dams or by extensive development will experience greater changes in discharge and water stress than unimpacted, free-flowing rivers (Palmer et al. 2008).

While debated, researchers anticipate: 1) the frequency and intensity of droughts and floods will change across the nation; 2) a warming of about $0.2^{o}C$ per decade; and 3) a rise in sea level (NAST 2000). A warmer and drier climate will reduce stream flows and increase water temperature resulting in a decrease of DO and an increase in the concentration of nutrients and toxic chemicals due to reduced flushing. Sea level is expected to continue rising: during the 20th century global sea level has increased 15 to 20 cm, and between 1985 and 1995 more than 32,000 acres of coastal salt marsh was lost in the southeastern U.S. due to a combination of human development activities, sea level rise, natural subsidence and erosion.

Effects on sea turtles globally

Sea turtle species have persisted for millions of years and throughout this time have experienced wide variations in global climate conditions. Throughout this time sea turtles have been able to adapt to environmental change. As such, climate change at normal rates (thousands of years) is not thought to have historically been a problem for sea turtle species. As explained in the "Status of the Species" sections above, sea turtles are most likely to be affected by climate change due to increasing sand temperatures at nesting beaches which in turn would result in increased female:male sex ratio among hatchlings, sea level rise which could result in a reduction in available nesting beach habitat, increased risk of nest inundation, a potential shift to more northern beaches for nesting, and changes in the abundance and distribution of forage species which could result in changes in the foraging behavior and distribution of sea turtle species. However, as noted in the "Status of the Species" section above, with the exception of green sea turtles, information on current effects of global climate change on sea turtles is not available and while it is speculated that future climate change may affect these species, it is not possible to quantify the extent to which effects may occur.

Effect of Climate Change in the Action Area

Information on how climate change will impact the action area is extremely limited. The Office of the New Jersey State Climatologist has summarized available information on a state-wide basis. Although there is much variation from year to year, these data show a statistically significant rise in average statewide temperature (approximately 2 degrees Fahrenheit) over the last 113 years. It is predicted that in the Northeastern US, precipitation, particularly in the form of rainfall, and runoff are expected to increase in future years (NECIA 2007). NOAA tide gauge data reported by the State indicates that the sea level at the New Jersey coast sites of Atlantic City, Cape May, and Sandy Hook has risen at a rate of approximately 4 mm/y since recording began in the early- to mid-1900s; anthropogenic contribution to the recent higher rate of rise is approximately 2 mm/y, approximately one-half of the total observed rate of rise, which is in line with recent estimates of the global rate.

As there is significant uncertainty in the changes that may be experienced in the action area due to climate change, it is difficult to predict the impact of these changes on sea turtles. However, as sea turtles do not nest within the action area any changes in Barnegat Bay due to climate change, such as rising sea levels which could increase beach erosion, would not affect nesting success. Similarly, any change in sand temperature at beaches in the action area would not affect the sex ratio of sea turtle hatchlings as sea turtles do not nest on these beaches. The most likely effect to sea turtles in the action area from climate change would be if warming temperatures led to changes in the seasonal distribution of sea turtles or sea turtle prey distribution and abundance. This would likely result in changes in foraging behavior by sea turtles in the action area and could lead to either an increase or decrease in the number of sea turtles in the action area, depending on whether there was an increase or decrease in the forage base and/or a seasonal shift in water temperature. For example, if there was a decrease in sea grasses in the action area resulting from increased water temperatures or other climate change related factors, it is reasonable to expect that there may be a decrease in the number of foraging green sea turtles in the action area. Likewise, if the prey base for loggerhead, Kemp's ridley or leatherback sea turtles was affected, there may be changes in the abundance and distribution of these species in the action area. Similarly, if water temperatures become warmer earlier in the year and stay warmer through the fall there may be a shift in the seasonal distribution of sea turtles in the action area, such that sea turtles may begin northward migrations from their southern overwintering grounds earlier in the spring and thus would be present in the action area earlier in the year. Similarly, if water temperatures were warmer in the fall, sea turtles could remain in the action area later in the year.

As described above, over the long term, global climate change may affect sea turtles by affecting the distribution of prey, water temperature and water quality; however, there is significant uncertainty, due to a lack of scientific data, on the degree to which these effects may be experienced and the degree to which sea turtles will be able to successfully adapt to any such changes. Any activities occurring within and outside the action area that contribute to global climate change are also expected to affect sea turtles in the action area. Scientific data on changes in sea turtle distribution and foraging behavior in the action area is not available. Therefore, it is not possible to say with any degree of certainty whether and how their distribution or foraging behavior in the action area have been or are currently affected by climate change related impacts. Implications of potential changes in the action area related to climate change are not clear in terms of population level impacts, data specific to these species in the action area are lacking. Therefore, any recent impacts from climate change in the action area are not quantifiable or describable to a degree that could be meaningfully analyzed in this consultation. However, given the likely rate of climate change, it is unlikely that there will be significant effects to sea turtles in the action area, such as changes in distribution or abundance, over the time period considered in this consultation (i.e., through April 2029) and it is unlikely that sea turtles in the action area will experience new climate change related effects not already captured in the "Status of the Species" section above concurrent with the proposed action.

Reducing Threats to ESA-listed Sea Turtles

NMFS has implemented multiple measures to reduce the capture and mortality of sea turtles in fishing gear, and other measures to contribute to the recovery of these species. While some of these actions occur outside of the action area for this consultation, the measures affect sea turtles that do occur within the action area.

Sea Turtle Handling and Resuscitation Techniques

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

Sea Turtle Entanglements and Rehabilitation

A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the USFWS, the U.S. Coast Guard, or any other Federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA (50 CFR 223.206(b)).

Education and Outreach Activities

Education and outreach activities do not directly reduce the threats to ESA-listed sea turtles. However, education and outreach are a means of better informing the public of steps that can be taken to reduce impacts to sea turtles (*i.e.*, reducing light pollution in the vicinity of nesting beaches) and increasing communication between affected user groups (*e.g.*, the fishing community). NMFS intends to continue these outreach efforts in an attempt to increase the survival of protected species through education on proper release techniques.

Sea Turtle Stranding and Salvage Network (STSSN)

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

Sea Turtle Disentanglement Network
NMFS Northeast Region established the Northeast Atlantic Coast Sea Turtle Disentanglement Network (STDN) in 2002. This program was established in response to the high number of leatherback sea turtles found entangled in pot gear along the U.S. Northeast Atlantic coast. The STDN is considered a component of the larger STSSN program and it operates in New Jersey. The NMFS Northeast Regional Office oversees the STDN program.

EFFECTS OF THE ACTION
This section of an 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). This Opinion examines the likely effects (direct and indirect) of the proposed action on sea turtles in the action area and their habitat within the context of the species current status, the environmental baseline and cumulative effects.

The proposed action has the potential to affect threatened and endangered sea turtles in several ways: impingement at either the CWS or DWS intake trash racks; capture of free swimming sea turtles in the intake bays; altering the abundance or availability of sea turtle prey items; and altering water quality through the discharge of heated and chlorinated effluent.

Sea Turtles in the Action Area
No surveys have been conducted for sea turtles in the action area specifically or Barnegat Bay generally. Based on the known seasonal migration patterns of sea turtles in coastal waters of the U.S. Mid-Atlantic and historic occurrence of sea turtles in Barnegat Bay and at the OCNGS, sea turtles are likely to occur in the action area from May-October, with the majority of sea turtles present between June and September. Sea turtles in Barnegat Bay generally and the action area specifically, are primarily juveniles, although occasional adults may be present.

Impingement and Capture of Sea Turtles
As explained above, 76 individual sea turtles have been captured at the OCNGS since 1992. Twenty-three of these turtles have been found dead. Of the live sea turtles, some were swimming

freely in the intake bays and were removed from the water with a dip net while the remaining were observed impinged on the trash rack and removed or discovered in the piles of debris removed from the trash rack by the mechanical rake. Nearly all of the sea turtles have evidence of interaction with the trash racks, including abrasions and bruising which suggests that even the live sea turtles were at least temporarily impinged on the rack or otherwise struggled to remove themselves from the area. There is currently no available data on the distribution of loggerheads, Kemp's ridleys and greens in the action area, in Barnegat Bay or in the coastal waters of New Jersey. This makes it impossible to determine that percentage of sea turtles in the action area that are affected by the operation of OCNGS. It is possible that sea turtles occur in the action area and are able to swim away from the intake bays without being detected and do not become impinged in the intake structure.

It is unclear why sea turtles enter the Forked River and encounter the OCNGS intake structures. In order to be present at the intake bays, live sea turtles must actively swim from Barnegat Bay into the Forked River and continue downstream to the intake bays. As the current velocity does not increase until within several meters of the intakes, it does not appear that sea turtles are subject to inescapable currents in the Forked River which would draw them to the intakes. It has been hypothesized that sea turtles are attracted to the intake screens when prey items such as blue crabs and horseshoe crabs are gathered there. For example, in 1992, a loggerhead removed from the CWS intake bay was released into the discharge canal. Two days later this turtle was recaptured at the CWS intake. This sea turtle would have had to actively swim back to the CWS intake area which suggests that the turtle was attracted to either the ambient conditions in the south fork of the Forked River or to the conditions at the intake trash racks. However, it is possible that the return of this sea turtle to the intake was a coincidence and that the turtle was not particularly attracted to the intake area. While sea turtles have not been documented in the discharge canal, conditions in the canal may also be attractive to sea turtles. The warm water discharge may increase the distribution of prey species to the area, and returns of live entrained organisms or dead fish and other material dumped from the traveling screens may provide food for the turtles or scavenging prey species.

As noted above, there was no program in place to monitor the intakes for sea turtles prior to 1992 and it is possible that some number of sea turtles have always occurred in the action area and that they went un-documented. While personnel did not monitor the intakes for sea turtles specifically, various impingement and entrainment observations and studies occurred prior to 1992; no sea turtles were recorded during this time. As the operation of the OCNGS has not changed appreciably since 1969, the onset of turtle captures in 1992 may be due to higher numbers of sea turtles in the action area or some change in ambient conditions that served to attract sea turtles to the intakes (e.g., prey availability). One possible explanation is that the presence of sea turtles in the action area changed due to the deepening of Barnegat Inlet in 1992. In association with the deepening, the south jetty at the entrance of Barnegat Bay was re-aligned. The combination of these activities provided for a greater volume of water and tidal range in the Barnegat Bay and in the vicinity of Oyster Creek. It has been hypothesized that this change in conditions may have contributed to a greater number of turtles entering the action area.

If maintenance dredging of the Intracoastal Waterway and Barnegat Inlet make the Bay more accessible to turtles, the frequency of impingements at OCNGS may increase after each dredging episode and decrease as the Bay fills with sediment. While difficult to quantify, an increase in the occurrence of oceanic fronts may have also contributed to an increase in turtles in Barnegat Bay, as Polovina et al. (2000) suggest that turtles use oceanic fronts as migratory and foraging habitat. If a greater number of turtles are in the offshore New Jersey waters as a result of the oceanic patterns and they migrate through the Barnegat Inlet, more sea turtles may be found in the action area. Sea turtles may enter the Barnegat Bay with an increase in waves, winds and tidal prism. The yearly fluctuations may also be attributable to biological factors such as the abundance of prey organisms (e.g., blue crabs, horseshoe crabs) in the vicinity of Oyster Creek.

The sea turtles likely to occur in the action area are too large to pass through the intake trash bars, which are constructed with 6.6 cm wide openings. Any sea turtle that is smaller than the trash bar opening would pass through the CWS intake trash bars and be transported to the water via the same traveling screen system that returns entrained fish and other small organisms. It is unlikely that turtles small enough to fit through the 6.6 cm wide opening will be in the vicinity of the OCNGS, because turtles of that size would be limited to hatchlings, a life stage not likely occur in inshore embayments, but rather in offshore currents (NMFS and USFWS 1992 and 1997).

As noted above both live and dead sea turtles have been found impinged at the OCNGS in the past, at both the DWS and CWS intakes. No sea turtles have been observed in the discharge canal. As water flow is away from this system, sea turtles would not be vulnerable to impingement or entrainment in the discharge canal. Sea turtles impinged at the intakes may suffocate or drown if they are unable to remove themselves from the trash bars and remain underwater for an extended period of time. At times when there is a heavy debris load at the intakes it may be more difficult for a sea turtle to remove itself from the trash bars. If sea turtles impinged on the trash bars are removed in time they may survive the impingement. Plant personnel estimated that many of the turtles that were taken at OCNGS had been impinged for up to 8 hours. In some natural situations, turtles may remain submerged for several hours. However, stress dramatically decreases the amount of time a turtle can stay submerged.

Under conditions of involuntary or forced submergence, sea turtles maintain a high level of energy consumption, which rapidly depletes their oxygen store and can result in large, potentially harmful internal changes (Magnuson et al. 1990). Those changes include a substantial increase in blood carbon dioxide, increases in epinephrine and other hormones associated with stress, and severe metabolic acidosis caused by high lactic acid concentrations. In forced submergence, a turtle becomes exhausted and then comatose; it will die if submergence continues. For example, trawl times for shrimpers in the southeast are limited by regulation to 55 minutes in the summer months and 75 minutes in the winter months, due to the fact that there is a strong positive correlation between tow time (i.e., forced submergence) and incidence of sea turtle death (Henwood and Stuntz 1987, Stebenau and Vietti 2000). Physical and biological factors that increase energy consumption, such as high water temperature and increased metabolic rates characteristic of small turtles, would be expected to exacerbate the harmful effects of forced submergence. Other factors, such as the level of dissolved oxygen in the water, the activity of the turtle and whether or not it has food in its stomach, may also affect the length of time it may stay submerged. It is likely that sea turtles impinged on the intake trash bars are already stressed; these conditions may increase the turtles' susceptibility to suffocation or drowning.

Nearly all of the sea turtles removed from OCNGS, including those recovered alive, have had evidence of injury sustained from contact with the trash bars. Typically this injury has been abrasions or bruising. Sea turtles may also be subject to injury from the operation of the trash rake which removes debris from the intake trash bars. The rake, a horizontal array of large curved tines, is lowered down into the bay to remove debris from the intake gratings. When the rake reaches the desired depth, the tines are deployed, curving downward to penetrate through the grate before the rake is raised. This process could cause serious injury to a turtle. Scrapes on a turtle's carapace could also result from interactions with the intake trash bars, or during rescue and retrieval by OCNGS personnel. Scrapes have been observed the carapace of several sea turtles removed from the intakes. Additionally, two of the sea turtles have had puncture wounds near the base of their necks which may be indicative of interactions with the tines of the trash rake.

All of the sea turtles at OCNGS have been collected between June and October. This is consistent with the presumption that because of seasonal fluctuations of water temperatures, loggerhead, Kemp's ridley, and green sea turtles only occur in the action area during this time period. As sea turtles are only likely to occur in the action area from June through October, it is reasonable to anticipate that impacts of the OCNGS on listed species will only be observed from June through October. The majority of sea turtles have been collected in July, followed by September. This may be reflective of the migratory nature of these species as they move up the coast in early summer and move back down the coast in the fall. There does not seem to be any discernible pattern in month by month species distribution. While the exact dates of capture have varied from year to year, the overall seasonal distribution of sea turtles at OCNGS does not appear to have changed over time.

The maximum number of turtles collected at OCNGS in one year was eleven (in 2009); 10 Kemp's ridleys and 1 green. In other years, the number has ranged from zero to 9. Prior to 2009, the highest number of turtles collected at OCNGS was 2004, with 8 Kemp's ridleys captured. Physical and biological factors may have played a role in attracting more turtles to the vicinity of OCNGS in 2004, 2009 and 2010 (the three years with the highest number of turtles at OCNGS). Oceanic water temperatures off of New Jersey were slightly higher during 2004 than in previous years. The NRC states that based on information provided from the National Weather Service, the average ocean water temperatures in New Jersey during the summer of 2004 were 1.4^{o}C above normal. This increase in water temperature may have been a factor attracting juvenile sea turtles to the waters of the mid-Atlantic searching for foraging and developmental habitats. Therefore, the increased water temperatures observed in Atlantic waters during the summer of 2004 may be a factor contributing to the high number of Kemp's ridley sea turtles taken at OCNGS that year. It is interesting to note that only 2 sea turtles were found at the OCNGS in 2005. The number of sea turtles at the facility likely reflects annual environmental fluctuation in the action area, such as water temperature, the proximity of the Gulf Stream, storm activity, and the quality and quantity of prey in the area. After 2005, numbers again increased with 6 sea turtles at OCNGS in 2006, 6 in 2008, 11 in 2009 and 9 in 2010; although, there were only 2 sea turtles at OCNGS in 2007.

Some of the between year fluctuation in sea turtles at the facility may be related to water temperatures in the mid-Atlantic, with more sea turtles likely to be captured at OCNGS during years when mid-Atlantic water temperatures are warmer. However, there is not enough information about specific conditions in the action area to make predictions about future fluctuations in sea turtle numbers.

More Kemp's ridleys are caught at OCNGS than loggerheads and greens, which is noteworthy, as there are thought to be more loggerheads than Kemp's ridleys in New Jersey waters. Kemp's ridleys may be more likely to become impinged in the intake structures due to their physiology and behavioral characteristics. Swimming efficiency is likely related to the size of a turtle, with larger turtles having a stronger swimming ability than smaller turtles. As such, it is possible that because the Kemp's ridleys and greens found impinged at OCNGS are generally smaller than the loggerheads they were not able to effectively escape the intake velocity (mean straight carapace length (SCL) of 48.94 cm for loggerheads (n=12) and SCL of 26.7 cm and 28.9 cm respectively for Kemp's ridley (n=52) and green sea turtles (n=9)). Of the 76 individual turtles found at OCNGS from 1992 through 2011, 53 of these turtles were found alive, and 23 were dead. Of the 12 loggerheads, 10 were alive at the time of removal from the water. Both loggerheads that were dead when removed from the water had necropsies completed which indicated that the loggerheads likely died prior to becoming impinged on the intakes. Of the 9 green sea turtles, only 1 was dead. While necropsy results are not available for this turtle, the lack of apparent injury or infection suggest it likely drowned or suffocated due to impingement. Of the 56 Kemp's ridleys observed at OCNGS since 1992, 20 were dead when removed from the intakes. Necropsies conducted on 5 Kemp's ridleys indicate they likely died prior to impingement on the intakes; one additional Kemp's showed signs of decomposition that indicated that it also was likely dead prior to impingement at the OCNGS. Of the 14 remaining dead Kemp's ridleys, necropsy results confirmed that 5 died from suffocation or drowning at the intakes. For two Kemp's ridleys necropsied (one in 2009 and one in 2010), no cause of death could be identified. The lack of noticeable injury or signs of decomposition suggest that the remaining 6 Kemp's also died from suffocation or drowning at the intakes. Overall, this information suggests that once at the intakes, the likelihood of mortality may be species dependent.

The ability of a given turtle to swim against the current at either the CWS or DWS intake and the condition at time of capture could depend on the species, size, relative health of each individual, or the particular conditions associated with each take (e.g., water temperature, duration of submergence time, etc.). Kemp's ridleys cannot survive underwater as long as other sea turtle species, as they have been found to drown faster in trawl nets compared to other species (Magnuson et al. 1990). A turtle weakened by disease or injured by a boat strike would be more susceptible to impingement if the velocity at the intake is a factor in the likelihood of impingement. Many of the sea turtles found impinged on the intake trash bars at OCNGS have previously been victims of collision with propellers. In several cases the wounds appear to be fresh, which may be a contributing factor to the impingement, as the sea turtle would be weak. Other sea turtles at OCNGS have been found to have abnormal blood results indicative of disease or were otherwise impaired (missing flipper, etc.).

As discussed above, smaller sea turtles are subject to a greater amount of stress if caught in an intake, as they have a lower swimming ability. The smaller size of the Kemp's ridley sea turtles found at OCNGS in combination with the increased susceptibility to drowning noted by Magnuson et al. (1990) may explain why this species seems to be more vulnerable to death at the intakes than the other species.

As noted above, sea turtles have been collected and impinged at both the CWS and DWS intakes. Of the 77 sea turtles collected from 1992 to 2011, 43 (56%) have occurred at the DWS intake and 34 (44%) at the CWS intake. From 1992 to 2011, 8 of 12 loggerheads (67%) captured at OCNGS have been retrieved from the CWS intake, while only 21 of the 56 Kemp's ridleys (34%) have been found at the CWS intake. The loggerheads incidentally captured have been generally larger than the Kemp's ridleys (average SCL 48.9 cm and 26.7cm, respectively), and the larger size of the loggerheads could result in more efficient swimming ability, allowing the animal to move around the floating ice/debris barrier and end up at the CWS intake. If Kemp's ridley and green turtles were found close to the surface and lacking the swimming ability or strength to dive beneath the floating ice/debris barrier, they would be channeled to the DWS intake. These species' prey are typically found on the bottom (e.g., crustaceans, marine grasses), which would suggest that they would not be on the surface if they were foraging.

Of the 23 dead sea turtles, 20 have been found at the DWS (87%). Of all the sea turtles found at the DWS, 48% were dead (20 of 42 total). This compares to approximately 9% of the sea turtles at the CWS found dead (3 of 35). This difference may be attributable to a number of factors but is most likely related to the presence of the debris/ice barrier which diverts floating debris away from the CWS intake and towards the DWS intake. A turtle that swims or drifts on the surface toward the OCNGS intakes may be turned towards the DWS by the floating wooden debris/ice barrier. The orientation of the barrier may result in turtles at the surface being funneled toward the DWS. However, there are gaps on either end which a turtle could easily swim through and the barrier only extends 2 feet below the surface, so a healthy turtle could easily swim under the barrier and turn left towards the CWS intake. Additionally, the intake velocity at the DWS is considerably higher than that of the CWS intake. This could make it more difficult for sea turtles to free themselves from the trash bars and increase the likelihood of drowning once impinged. The presence of a greater amount of grasses and other debris at the DWS may also make it more difficult for sea turtles to free themselves from the trash bars and may make it more difficult for plant personnel to spot sea turtles here and remove them from the trash bars in time to prevent drowning. More Kemp's ridleys and greens have been found at the DWS than loggerheads, as these species have been found to have an overall smaller average carapace length than the loggerheads, they may be more susceptible to drowning due to their smaller size and lower swimming ability, especially when stressed. It is also likely that any previously dead sea turtles that float into the area would be diverted to the DWS intake and be discovered there.

As noted above, not all of the dead sea turtles collected at OCNGS died as a result of the operation of the facility. However, as only some of the dead sea turtles have been necropsied, it is difficult to definitively determine the cause of death for many of these turtles. As explained above, of the 23 dead sea turtles, necropsy results indicated that 6 of the sea turtles were dead prior to becoming impinged or captured. Signs of decomposition and injury suggest that an additional 2 sea turtles may also have been dead prior to becoming impinged. The cause of death for 2 Kemp's ridleys was unable to be determined, despite a complete necropsy. The cause of death for the other 13 sea turtles is likely suffocation or drowning at OCNGS, with 6 of these confirmed by necropsy. Additionally, 2 sea turtles were removed from the water alive at OCNGS but later died. While both sea turtles showed signs of previous illness or injury, it is unknown if interactions at OCNGS contributed to their death.

In addition to injury and mortality, impingement or capture at the OCNGS intake could result in the interruption of migration and the eventual loss of nesting opportunities. Sea turtles migrate to northeastern waters when the waters warm in the late spring and early summer, returning south in the late fall. While turtles may be in the action area for foraging purposes, it is possible that turtles are migrating through the area in the spring on their way to more suitable foraging habitats in the Northeast, or in the fall on their way to overwintering areas. If interactions at the OCNGS impedes normal behaviors, this would affect typical sea turtle migration and/or foraging patterns. Most of the sea turtles found at OCNGS are juveniles and are not yet partaking in nesting. However, if impingement results in mortality, these animals would not nest in the future and would not subsequently contribute to the population.

The continued operation of the OCNGS for the remainder of its 20 year license will not cause any operational changes at the CWS or DWS intakes that are likely to cause a different rate of impingement or capture of sea turtles than has been observed in the past. As noted above, the number of sea turtles in the action area is variable each year depending on environmental factors such as water temperature, weather patterns and prey availability and may also be related to dredging and shoaling actions in Barnegat Bay and this variability is likely to continue. Over time, there has been a general increase in the number of Kemp's ridley and green sea turtles and a decrease in the number of loggerheads captured at the facility. From 1992-2000, an average of 1 Kemp's ridley, 1 loggerhead and less than 1 green sea turtles were captured at the facility each year, with a total of 8 Kemp's ridley, 8 loggerhead and 2 green sea turtles over this period. From 2001-2011, an average of 4 Kemp's ridley, less than 1 loggerhead and 1 green sea turtle was captured at the facility, with a total of 43 Kemp's ridley, 4 loggerheads and 7 green sea turtles over this period. While it is impossible to determine what has caused this shift in species distribution at the OCNGS, there have been no operational changes at the facility that would account for this shift. It may be linked to factors affecting these species globally (i.e., outside of the action area) or may be related to a change in distribution of prey species or climate related factors, such as increased water temperatures. However, as the shift in the sea turtle species observed at OCNGS has been sustained over at least the last 10 years (2001-2011), it is reasonable to anticipate that it is likely to continue over the remainder of the 20 year operating license.

Using the mean number of sea turtles of each species captured or impinged at OCNGS over the last 12 years (2000-2011, inclusive; 4.3 Kemp's ridley/year, 0.36 loggerheads/year, 0.64 greens/year), NMFS has calculated the number of sea turtles of each species likely to be captured or impinged at OCNGS over the duration of the facility's operating license (i.e., 2012- April 2029). Using this method, NMFS anticipates that over the upcoming 16 year period[4], a total of 71 Kemp's ridley, 6 loggerhead, and 11 green sea turtles are likely to be captured or impinged at the OCNGS. Based on the observation of sea turtles captured at the facility in the past, it is likely that nearly all of the sea turtles captured will suffer from some degree of injury, likely abrasions and bruising, due to interactions with the trash bars. However, if rescued alive, these injuries are not expected to be life threatening and sea turtles are expected to make a complete recovery. This assumption is validated by reports provided by MMSC where, in recent years, all turtles captured at OCNGS have been transported to and observed by qualified sea turtle biologists prior to eventual release.

NMFS anticipates that sea turtles will continue to die due to suffocation and drowning caused by impingement on the trash bars. Using information on the number of dead sea turtles of each species captured or impinged at the facility NMFS has calculated a mortality rate for each species5 (0.36 for Kemp's ridley, 0.17 for loggerheads, and 0.11 for greens). While NMFS recognizes that some number of previously dead sea turtles may become impinged on the intake trash bars each year, the difficulty in definitively determining a cause of death and the inconsistency in the applicant's ability to obtain necropsy results for dead sea turtles makes it difficult to accurately predict the number of previously dead sea turtles that will become impinged on the intakes each year; therefore, NMFS has assumed for purposes of this analysis, that any dead sea turtle collected at OCNGS was killed as a result of operations of the facility. Using this method, NMFS anticipates that over the remainder of the 20 year operating license, a total of 26 Kemp's ridley, 1 loggerhead, and 2 green sea turtles will be killed as a result of operations of the OCNGS.

Effects on Prey

Significant numbers of aquatic organisms besides sea turtles are also impinged at the CWS and DWS intakes and large volumes of small organisms are entrained at both intakes. It has been hypothesized that sea turtles are attracted to the intakes due to the high concentration of sea turtle forage items, particularly blue crabs, horseshoe crabs and sea grasses, which are found at the intakes.

4The license will expire in April 2029. As sea turtles are only present in the action area May – October, no sea turtles are likely to be captured or impinged in 2029, thus NMFS has considered the potential for interactions over 16 "sea turtle seasons," 2012-2028.

5 This rate was calculated by dividing the number of dead sea turtles by species by the total number captured or impinged of that species. Given the uncertaintity associated with determining cause of death, for purposes of this calculation, the operation of OCNGS was assumed to have caused or contributed to the cause of death.

In addition to concentrating sea turtle forage items at the intakes, the operation of the OCNGS intakes causes a large number of potential sea turtle prey items to be lost each year. Several of the species subject to impingement and entrainment at the OCNGS are potential prey for sea turtles, including blue crabs, hard clams and several shrimp species. Recent data on rates of impingement and entrainment are not available. However, studies reviewed by the NJ DEP (NJDEP draft NPDES permit 2005) indicate that the equivalent of 59,000 adult hard clams and 10,400 blue crabs are lost to impingement and entrainment each year. This represents a large number of organisms that are no longer available for sea turtles to prey upon in the action area. In addition to clams and crabs, several million shrimp and fish are also subject to impingement and entrainment at the facility each year. While the OCNGS causes the death of many thousands of potential sea turtle forage items each year, the effect of this loss of prey on sea turtles in the action area is unknown; however, there is no evidence that sea turtles in the action area are affected by a reduction in the availability of forage items. For example, sea turtles removed from the intakes display no evidence of starvation or other indications of a lack of quality forage. Additionally, if sea turtles were limited by available forage items in the action area, it is likely that numbers of sea turtles at the OCNGS would be decreasing when in fact the numbers show an increasing trend. Based on the best available information, while the OCNGS reduces the amount of sea turtle forage items available for sea turtles in the action area, this loss appears to be insignificant to sea turtles in the action area.

Effects on Water Quality

The water quality of effluents discharged from the OCNGS is regulated through the New Jersey Pollution Discharge Elimination System (NJPDES) program. The NJDPES permit specifies the discharge standards and monitoring requirements for each discharge. Under this regulatory program, Exelon treats wastewater effluents, collects and disposes of potential contaminants, and undertakes pollution prevention activities.

The NJPDES permit for this facility was last issued in 1994. This permit expired in 1999 and has been administratively extended each year. A draft permit was submitted for public comment in July 2005 and a revised draft permit was submitted for public comment in January 2010; a subsequent revised draft permit was released for public comment in June 2011. To date, no action has been taken on the draft permit and the facility is still operating under the terms of the 1994 permit. As such, the effects of the OCGNS continuing to operate under the terms of the 1994 permit will be discussed below.

Impacts of chlorine used at the OCNGS

Low level, intermittent chlorination is used to control biofouling in the OCNGS service water system and circulating water systems. The main condenser cooling water is chlorinated for a maximum of two hours per day. The permitted maximum daily concentration of chlorine discharge is 0.2 mg/l or a maximum daily chlorine usage of 41.7 kg/day. The NRC has stated that the chlorine demand in the main condenser discharge consumes almost all remaining free chlorine and results in very little chlorine being released to the discharge canal (approximately 0.1 mg/l). The DWS does not have any chlorine discharges.

Chemical contaminants have been found in the tissues of sea turtles from certain geographical areas. While the effects of chemical contaminants on turtles are relatively unclear, they may have an effect on sea turtle reproduction and survival. Chemical contaminants may also affect the immune system, making sea turtles more susceptible to disease and other stresses. There is no information available on the effects of chlorination on sea turtles. It is also unknown as to whether the sea turtles impinged at OCNGS had appreciable levels of chlorine in their tissues. The necropsies conducted on the sea turtles found at the OCNGS did not assess the levels of contaminants in the tissue.

There are a number of studies that have examined the effects of Chlorine Produced Oxidants (also referred to as Total Residual Chlorine or TRC) on aquatic life (Post 1987; Buckley 1976); however, no directed studies that have examined the effects of CPO on sea turtles have been conducted. The EPA has set the Criteria Maximum Concentration[6] for exposure to chlorine at 0.019mg/L.

As noted above, the daily maximum "end-of-pipe" concentration (i.e., the concentration of TRC in the effluent as it discharges into the receiving water) allowed by the permit is 0.2mg/L. The anticipated TRC level at the point of discharge is significantly higher than EPA's ambient water quality criteria and higher than chlorine levels known to be protective of aquatic life. The chlorinated water is mixed with unchlorinated water from the DWS system at the point of discharge and is rapidly diluted before it enters Barnegat Bay, the area where the highest number of sea turtles are likely to be present. It is also important to note that elevated chlorine levels are not known to occur at the CWS and DWS intakes where sea turtles are likely to be present for extended periods of time, but only at the discharges where sea turtles have not been observed. Based on the best available information, due to the rapid dilution of chlorinated effluent, the level of chlorination at the OCNGS is believed to have an insignificant effect on sea turtles in the action area.

The chlorine discharge may also have an effect on sea turtle forage items. Chlorine is used in the plant as a biocide, and the discharge of this chemical could kill sea turtle forage items or cause them to leave the area, thus reducing the number available to sea turtles. However, as explained above, there is no indication that sea turtles in the action area are limited by the amount of available forage. Additionally, blue crabs, one of the main forage items for sea turtles in the action area, are relatively insensitive to chlorine levels. For example, EPA has reported LC50 levels for blue crabs of 0.7 – 0.86mg/L (EPA 1986). Based on the best available information, while the discharge of chlorinated effluent may affect individual sea turtle forage items, the level of chlorination at the OCNGS is believed to have an insignificant effect on the ability for sea turtles to forage successfully in the action area.

Heated Effluent

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6 CMC or acute criteria; defined in 40 CFR 131.36 as equals the highest concentration of a pollutant to which aquatic life can be exposed for a short period of time (up to 96 hours) without deleterious effects

Heated condenser cooling water discharged from the CWS and ambient temperature intake canal water discharged from the DWS meet and mix in the discharge canal and are returned to Barnegat Bay via this canal. This process results in heated discharge water mixing with the ambient water and elevating the normal water temperatures. The NJPDES permit for this facility limits the discharge of heated effluent to an instantaneous maximum of 41.1°C or 12.8°C above ambient. The temperature rise of the CWS discharge is typically about 11^{o}C above ambient canal temperatures, while the DWS discharge is approximately 5.6^{o}C above ambient water temperatures when two dilution pumps are operating.

The impacts of the thermal plume in Barnegat Bay appear to be on the surface and relatively small, thus reducing the potential for negative affects to sea turtles. The cooling water discharged from OCNGS has been studied on several occasions to determine the distribution, geometry, and dynamic behavior of the thermal plume (OCNGS 2000). While the discharge temperature near OCNGS is high, the turbulent dilution mixing produces rapid temperature reductions. Little mixing with the heated discharge and ambient water occurs in Oyster Creek from the site of the discharge to the Bay, because of the relatively short residence time and the lack of turbulence or additional dilution. However, in Barnegat Bay, temperatures are rapidly reduced when mixing with ambient temperature Bay water occurs as well as heat rejection into the atmosphere. In Barnegat Bay, the plume occupies a relatively large surface area (estimated to be less than 1.6 km in an east-west direction by 5.6 km in a north-south direction, under all conditions) and in general, elevated temperatures do not extend to the bottom of the Bay except in the area immediately adjacent to the mouth of Oyster Creek. While the plume in Barnegat Bay is on the surface, sea turtles may be exposed to the plume as they are coming up for air.

Excessive heat exposure (hyperthermia) is a stress to sea turtles but is a rare phenomenon when sea turtles are in the ocean (Milton and Lutz 2003). As such, limited information is available on the impacts of hyperthermia on sea turtles. Environmental temperatures above 40°C can result in stress for green sea turtles (Spotila et al. 1997). Sea turtle eggs exposed to temperatures above 38°C typically fail to hatch (Bustard and Grehan 1967). As noted above, the daily maximum "end-of-pipe" temperature is 41.1°C. However, the maximum temperatures recorded in the discharge canal were 38°C during a dilution pump failure event in 2002. It is also important to note that elevated temperature is not known to occur at the CWS and DWS intakes where sea turtles are likely to be present for extended periods of time, but only at the site of the discharges where sea turtles have not been observed.

While sea turtles will not likely be killed by the elevated temperatures, temperature increases may affect normal distribution and foraging patterns. The thermal effluent discharged from the plant into Oyster Creek may represent an attraction for turtles. If turtles are attracted into Oyster Creek by this thermal plume, they could remain there late enough in the fall to become cold-stunned when they finally travel into Barnegat Bay at the start of their southern migration. Cold stunning occurs when water temperatures drop quickly and turtles become incapacitated. The turtles lose their ability to swim and dive, lose control of buoyancy, and float to the surface (Spotila et al. 1997). If sea turtles are concentrated around the heated discharge or in surrounding waters heated by the discharge (e.g., Oyster Creek or Barnegat Bay) and move outside of this plume into cooler waters (approximately less than 8-10°C), they could become cold stunned. However, existing data from OCNGS and other power plants in the NMFS Northeast Region do not support the concern that warm water discharge may keep sea turtles in the area until surrounding waters are too cold for their safe departure. Data reported by the STSSN indicate that cold-stunning has occurred around mid-November in New York waters. No incidental captures of sea turtles have been reported at the OCNGS later than October, with the minimum recorded temperature at time of capture of 11.8°C, suggesting that sea turtles leave the action area before cold-stunning could potentially occur.

While cold stunning could still occur given the heated discharge and the water temperatures in New Jersey during certain times of the year (e.g., less than 10°C), NRC has identified certain aspects of the OCNGS discharge that may make cold stunning less likely to occur. For example, the area where sea turtles could overwinter (and encounter acceptable water temperatures) is limited to the small area around the condenser discharge, prior to any mixing with the DWS flow. Winter water temperatures in the discharge canal, downstream of the area where the DWS and CWS flows mix, routinely fall below 7.2°C. These temperatures in the discharge canal would not be suitable for sea turtle survival. Sea turtles generally are found in water temperatures greater than 10°C, but have occasionally been documented in colder waters. For example, in March 1999, a live loggerhead sea turtle was observed taken on a monkfish gillnet haul in North Carolina, in a water temperature of 8.6°C. In any event, during the winter, the area where the water temperatures would be suitable for sea turtles is small and localized. Based on the best available information, there is no evidence that the discharge of heated effluent increases the vulnerability of sea turtles in the action area to cold stunning.

Effect on Sea Turtle Prey

Cold shock mortalities of fish have occurred at OCNGS when water temperatures have decreased in the fall. There is no evidence that sea turtles have been adversely affected by any mass mortality of fish or that sea turtle prey have been impacted by cold shock events. The number and severity of these events have been reduced as a result of the operation of the two dilution pumps in the fall, when ambient water temperatures began to drop, to decrease the attractiveness of the discharge canal as overwintering habitat. As mentioned, cold stunning of sea turtles has not been documented at OCNGS, but the measures to reduce cold shock mortalities of fish would also help reduce the potential for cold stunning of sea turtles.

Heat shock events have also been recorded at OCNGS. For example, on September 23, 2002, 5,876 fish were killed. NRC reports that the mortality was attributed to heat shock because of an accidental shutdown of the dilution pumps during a routine electrical maintenance procedure. During that event, the water temperature in the discharge canal rose from approximately 32.8°C to 38.3°C within 3 hours of pump shutdown and the temperature at this location remained at 37.8°C for several hours until the dilution pump operation was restored. High temperatures recorded during this event are the highest temperatures on record for the action area. There is no evidence that any sea turtles were in the impact area during this event.

The thermal discharges from OCNGS may influence the distribution and survival of sea turtles' primary prey resources. Blue crab and horseshoe crab are found in the canal, generally during the warmer months, but the effect of the heated effluent on the distribution of these species is uncertain. Crustaceans may move elsewhere when conditions are unfavorable (e.g., elevated water temperatures), but there is no information at this time suggesting that this has occurred at OCNGS. It is probable that when sea turtles are foraging in the summer, the heated effluent will not have as great of an impact on the turtles as it would in the winter. Furthermore, the New Jersey DEP evaluated the impact of the OCNGS thermal plume on Barnegat Bay and concluded that the effects on fish distribution and abundance were small and localized (Summers et al. 1989 in OCNGS 2000). Thus, it appears that the preferred prey of loggerhead, Kemp's ridleys, and greens are impacted insignificantly, if at all, by the thermal discharge from OCNGS and that there are no significant impacts on the ability of sea turtles to forage due to this discharge.

CUMULATIVE EFFECTS

Cumulative effects as defined in 50 CFR 402.02 to include the effects of future State, tribal, local or private actions that are reasonably certain to occur within the action area considered in the 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. Ongoing Federal actions are considered in the "Environmental Baseline" section above.

Natural mortality of sea turtles, including disease (parasites), predation, and cold-stunning, occurs in mid-Atlantic waters. In addition to impingement in the OCNGS intakes, sources of human-induced effects on turtles in the action area include incidental takes in state-regulated fishing activities, vessel collisions, ingestion of plastic debris, and pollution. While the combination of these unrelated, non-federal activities in Barnegat Bay may adversely affect populations of endangered and threatened sea turtles.

State Water Fisheries - NMFS believes that the fishing activities in Barnegat Bay will continue in the future, and as a result, sea turtles will continue to be impacted by fishing gear used in the action area. Throughout their range, sea turtles have been taken in different types of gear, including gillnet, pound net, rod and reel, trawl, pot and trap, longline, and dredge gear. Thus, it is likely that commercial and recreational fisheries in the action area will continue to impact sea turtles, albeit to an unknown extent.

Vessel Interactions – NMFS' STSSN data indicate that vessel interactions are responsible for a large number of sea turtles strandings within the action area each year. Such collisions are reasonably certain to continue into the future. Collisions with boats can stun or easily kill sea turtles, and many stranded turtles have obvious propeller or collision marks (Dwyer *et al.* 2003). However, it is not always clear whether the collision occurred pre- or post-mortem. Fifty to 500 loggerheads and 5 to 50 Kemp's ridley turtles are estimated to be killed by vessel traffic per year in the U.S. (National Research Council 1990). Although some of these strikes may be post-mortem, the data show that vessel traffic is a substantial cause of sea turtle mortality. As turtles will likely be in the area where high vessel traffic occurs, the potential for collisions with vessels transiting these waters exists. The MMSC in Brigantine, New Jersey, reports an increase in the number of turtles hit by boats in New Jersey inshore and nearshore waters, as determined from sea turtle stranding records. NMFS believes that sea turtles takes by vessel interactions will continue in the future. An estimate of the number of sea turtles that will likely be killed by vessels is not available from data at this time.

Pollution and Contaminants – Human activities in the action area causing pollution are reasonably certain to continue in the future, as are impacts to sea turtles resulting from exposure to this pollution. However, the level of impacts cannot be projected. Sources of contamination in the action area include atmospheric loading of pollutants, stormwater runoff from coastal development, groundwater discharges, and industrial development. Chemical contamination may have an effect on listed species reproduction and survival. While the effects of contaminants on sea turtles are not well documented, pollution may also make sea turtles more susceptible to disease by weakening their immune systems. Marine debris (*e.g.*, discarded fishing line or lines from boats) can entangle turtles in the water and drown them. Turtles commonly ingest plastic or mistake debris for food. Chemical contaminants may also have an effect on sea turtle reproduction and survival. Excessive turbidity due to coastal development and/or construction sites could influence sea turtle foraging ability. As mentioned previously, turtles are not very easily affected by changes in water quality or increased suspended sediments, but if these alterations make habitat less suitable for turtles and hinder their capability to forage, eventually they would tend to leave or avoid these areas (Ruben and Morreale 1999).

Twenty-eight percent of the land around Barnegat Bay is developed. In the future, a larger amount of the watershed will likely be developed because Barnegat Bay supports a thriving tourist industry and more individuals are moving to the coast in general. An increase in boating, fishing, and general use of the Bay is also likely to occur. With this increase in development and utilization of the Bay, there is a greater potential for debris and pollutants to enter the waters of the action area. Sea turtles will continue to be impacted by pollution in the Bay and any increase in debris or pollutants would exacerbate this effect. Marine debris (e.g., discarded fishing line or lines from boats) can entangle turtles in the water and drown them. Turtles commonly ingest plastic or mistake debris for food. Storm water runoff and other sources of nonpoint source pollution may result in the waters containing chemical contaminants. The Barnegat Bay estuary may be more susceptible to toxic chemical contaminants than many other estuaries because of its limited dilution capacity and flushing rate (Barnegat Bay Estuary Program 2001). Chemical contaminants may have an effect on sea turtle reproduction and survival, but the impacts are still relatively unclear.

Global climate change is expected to continue and may impact sea turtles and their habitat in the action area. Rising temperatures and sea levels may affect sea turtle sex ratios and could result in increased egg mortality. No sea turtle nesting takes place in the action area. However, turtles in the action area come from nesting sites that may be affected by climate change related impacts. Alterations to foraging habitats and prey resources and potential changes in migratory pathways and range expansion are additional ways that sea turtles in the action area may continue to be impacted by climate change. Although there is much speculation on the potential impacts of climate change to species and ecosystems, there is significant uncertainty associated with any of these analyses making it impossible to accurately predict the most likely scenario that will result and consequently what impacts will be experienced by species and their habitats. Any predictions on future effects to sea turtles in the action area resulting from climate change are speculative. In addition to the uncertainty of the rate, magnitude and distribution of future climate change and its impacts to sea turtles, the adaptability of these species and the ecosystems on which they depend is unknown. Sea turtles may exhibit a variety of adaptations to cope with climate change-related impacts, although it will likely take decades to centuries for both climate-related impacts and associated adaptations to occur (Limpus 2006), which further complicates any prediction of future impacts of climate change on sea turtles in the action area. As noted in the Status of the Species and Environmental Baseline sections above, only limited data are available on past trends related to climate effects on sea turtles and current scientific methods are not able to reliably predict the future magnitude of climate change and associated impacts or the adaptive capacity of this species. While there is a reasonable degree of certainty that certain climate change related effects will be experienced (e.g., rising temperatures and changes in precipitation patterns), due to a lack of scientific data, the specific effects to sea turtles resulting from climate change are not currently predictable or quantifiable (Hawkes et al. 2009). However, given the likely rate of change associated with climate impacts (i.e., the century scale), it is unlikely that climate related impacts will have a significant effect on any species of sea turtles (e.g., changes in status, distribution, abundance or behavior resulting from effects of climate change) in the action area over the temporal scale of the proposed action (i.e., through April 2029).

INTEGRATION AND SYNTHESIS OF EFFECTS

NMFS has estimated that the proposed action, the continued operation of the OCNGS over the course of the remainder of the 20 year life of the license (i.e., 2012- April 2029), will result in the capture or impingement of up to 71 Kemp’s ridley sea turtles, 6 loggerhead sea turtles and 11 green sea turtles, with mortalities of up to 26 Kemp’s ridleys, 1 loggerhead, and 2 green sea turtles. As explained in the “Effects of the Action” section, effects of the facility on sea turtle prey items and the effect of the discharge of pollutants, including chlorine and heat, will be insignificant or discountable.

In the discussion below, NMFS considers whether the effects of the proposed action reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species in the wild by reducing the reproduction, numbers, or distribution of the species. The purpose of this analysis is to determine whether the proposed action would jeopardize the continued existence of the species. In the NMFS/USFWS Section 7 Handbook, for the purposes of determining jeopardy, survival is defined as, “the species’ persistence as listed or as a recovery unit, beyond the conditions leading to its endangerment, with sufficient resilience to allow for the potential recovery from endangerment. Said in another way, survival is the condition in which a species continues to exist into the future while retaining the potential for recovery. This condition is characterized by a species with a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring, which exists in an environment providing all requirements for completion of the species’ entire life cycle, including reproduction, sustenance, and shelter." Recovery is defined as, "Improvement in the status of listed species to the point at which listing is no longer appropriate under the criteria set out in Section 4(a)(1) of the Act." Below, for each of the listed species that may be affected by the proposed action, NMFS summarizes the status of the species and considers whether the proposed action will result in reductions in reproduction, numbers or distribution of that species and then considers whether any reductions in reproduction, numbers or distribution resulting from the proposed action would reduce appreciably the likelihood of both the survival and recovery of that species, as those terms are defined for purposes of the federal Endangered Species Act.

Kemp's Ridley sea turtles are listed as a single species classified as "endangered" under the ESA. Kemp's ridleys occur in the Atlantic Ocean and Gulf of Mexico. The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963; USFWS and NMFS 1992; NMFS and USFWS 2007c).

Nest count data provides the best available information on the number of adult females nesting each year. As is the case with the other sea turtles species discussed above, nest count data must be interpreted with caution given that these estimates provide a minimum count of the number of nesting Kemp's ridley sea turtles. In addition, the estimates do not account for adult males or juveniles of either sex. Without information on the proportion of adult males to females, and the age structure of the Kemp's ridley population, nest counts cannot be used to estimate the total population size (Meylan 1982; Ross 1996; Zurita *et al.* 2003; Hawkes *et al.* 2005; letter to J. Lecky, NMFS Office of Protected Resources, from N. Thompson, NMFS Northeast Fisheries Science Center, December 4, 2007). Nevertheless, the nesting data does provide valuable information on the extent of Kemp's ridley nesting and the trend in the number of nests laid. Based on the number of nests laid in 2006 and the remigration interval for Kemp's ridley sea turtles, there were an estimated 7,000-8,000 adult female Kemp's ridleys in 2006 (NMFS and USFWS 2007c), which represents an increase in the nesting trend for Kemp's ridleys.

The most recent review of the Kemp's ridley as a species suggests that it is in the early stages of recovery (NMFS and USFWS 2007b). Nest count data indicate increased nesting and increased numbers of nesting females in the population. NMFS also takes into account a number of recent conservation actions including the protection of females, nests, and hatchlings on nesting beaches since the 1960s and the enhancement of survival in marine habitats through the implementation of TEDs in the early 1990s and a decrease in the amount of shrimping off the coast of Tamaulipas and in the Gulf of Mexico in general (NMFS and USFWS 2007b). More female Kemp's ridley sea turtles are maturing and subsequently nesting, and/or are surviving to an older age and producing more nests across their lifetime, resulting in a positive population trend globally.

There are no assessments of Kemp's ridley sea turtles in New Jersey waters generally or the action area specifically; thus, NMFS is not able to make any conclusions regarding the number or trends for Kemp's ridleys in the action area. However, since records of sea turtle interactions at OCNGS began in 1992, there has been an upward trend of observations of Kemp's ridley sea turtles at OCNGS. This upward trend may be reflective of an increase in Kemp's ridleys in the action area, which may be related to a global population increase. Kemp's ridley sea turtles that occur in the action area will continue to experience anthropogenic and natural sources of mortality. However, NMFS is not aware of any future actions that are reasonably certain to occur that area likely to change the trend or reduce the stability of Kemp's ridleys globally or within the action area. Also, as discussed above, NMFS does not expect Kemp's ridleys to experience any new effects associated with climate change during the time period covered by this consultation (i.e., through April 2029). As such, NMFS expects that numbers of Kemp's ridleys in the action area will continue to be stable over the duration of the proposed action.

NMFS has estimated that the continued operation of OCNGS through the duration of its operating license (i.e., through April 2029), will result in the impingement or capture of up to 71 Kemp's ridley sea turtles; up to 26 of these sea turtles may die as a result of impingement at the OCNGS intakes.

Live turtles captured at the facility may have minor injuries; however, they are expected to make a complete recovery without any impairment to future fitness. Capture at OCNGS will temporarily prevent these sea turtles from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the turtles are returned to the wild. The capture of live Kemp's ridley sea turtles from the OCNGS intakes is not likely to reduce the numbers of Kemp's ridley sea turtles in the action area, the numbers of Kemp's ridley in any subpopulation or the species as a whole. Similarly, as the capture of live Kemp's ridley sea turtles from the OCNGS intakes will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live Kemp's ridley sea turtles from the OCNGS intakes is also not likely to affect the distribution of Kemp's ridley sea turtles in the action area or affect the distribution of sea turtles throughout their range. As any effects to individual live Kemp's ridley sea turtles removed from the intakes will be minor and temporary there are not anticipated to be any population level impacts.

The mortality of up to 26 Kemp's ridleys represents a very small percentage of the Kemp's ridleys worldwide. Even taking into account just nesting females, the death of up to 26 Kemp's ridleys represents less than 0.4% of the population. While the death of up to 26 Kemp's ridleys will reduce the number of Kemp's ridleys compared to the number that would have been present absent the proposed action, it is not likely that this reduction in numbers will change the status of this species or its stable to increasing trend as this loss represents a very small percentage of the population (less than 0.4%). Reproductive potential of Kemp's ridleys is not expected to be affected in any other way other than through a reduction in numbers of individuals. A reduction in the number of Kemp's ridleys would have the effect of reducing the amount of potential reproduction as any dead Kemp's ridleys would have no potential for future reproduction. In 2006, the most recent year for which data is available, there were an estimated 7-8,000 nesting females. While the species is through to be female biased, there are likely to be several thousand adult males as well. Given the number of nesting adults, it is unlikely that the loss of 26 Kemp's ridleys would affect the success of nesting in any year. Additionally, this small reduction in potential nesters is expected to result in a small reduction in the number of eggs laid or hatchlings produced in future years and similarly, a very small effect on the strength of subsequent year classes. Even considering the potential future nesters that would be produced by the individuals that would be killed as a result of the proposed action, any effect to future year classes is anticipated to be very small and would not change the stable to increasing trend of this species. Additionally, the proposed action will not affect nesting beaches in any way or disrupt migratory movements in a way that hinders access to nesting beaches or otherwise delays nesting.

The proposed action is not likely to reduce distribution because the action will not impede Kemp's ridleys from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors. Additionally, given the small percentage of the species that will be killed as a result of the operations of OCNGS, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of Kemp's ridleys because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of Kemp's ridleys is likely to be increasing and at worst is stable.

Based on the information provided above, the death of up to 26 Kemp's ridley sea turtles over the remainder of the OCNGS operating license will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect Kemp's ridleys in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent Kemp's ridleys from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the species' nesting trend is increasing; (2) the death of 26 Kemp's ridleys represents an extremely small percentage of the species as a whole; (3) the death of 26 Kemp's ridleys will not change the status or trends of the species as a whole; (4) the loss of these Kemp's ridleys is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of these Kemp's ridleys is likely to have such a small effect on reproductive output that the loss of these individuals will not change the status or trends of the species; (5) the action will have only a minor and temporary effect on the distribution of Kemp's ridleys in the action area and no effect on the distribution of the species throughout its range; and, (6) the action will have no effect on the ability of Kemp's ridleys to shelter and only an insignificant effect on individual foraging Kemp's ridleys.

In certain instances an action that does not appreciably reduce the likelihood of a species survival (persistence) may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that Kemp's ridleys will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate. Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of Kemp's ridley sea turtles in any geographic area and since it will not affect the overall distribution of Kemp's ridley sea turtles other than to cause temporary delays in migratory movements. The proposed action will not utilize Kemp's ridley sea turtles for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect this species or affect itscontinued existence. The proposed action is likely to result in the mortality of up to 26 Kemp's ridleys; however, as explained above, the loss of these individuals and what would have been their progeny is not expected to affect the persistence of Kemp's ridleys. As the reduction in numbers and future reproduction is very small, the loss of these individuals will not change the status or trend of Kemp's ridleys, which is stable to increasing. The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction since the action will cause the mortality of only a very small percentage of the species as a whole and these mortalities are not expected to result in the reduction of overall reproductive fitness for the species as a whole. The effects of the proposed action will also not reduce the likelihood that the status of the species can improve to the point where it is recovered and could be delisted. Therefore, the proposed action will not appreciably reduce the likelihood that Kemp's ridleys can be brought to the point at which they are no longer listed as endangered or threatened. Based on the analysis presented herein, the proposed action, resulting in the capture or impingement of no more than 71 Kemp's ridleys and the mortality of no more than 26 of those individuals, is not likely to appreciably reduce the survival and recovery of this species.

The *Northwest Atlantic DPS of loggerhead sea turtles* is listed as "threatened" under the ESA. It takes decades for loggerhead sea turtles to reach maturity. Once they have reached maturity, females typically lay multiple clutches of eggs within a season, but do not typically lay eggs every season (NMFS and USFWS 2008). There are many natural and anthropogenic factors affecting the survival of loggerheads prior to their reaching maturity as well as for those adults who have reached maturity. As described in the Status of the Species/Environmental Baseline and Cumulative Effects sections above, loggerhead sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration, dredging, power plant intakes and other factors that result in mortality of individuals at all life stages. Negative impacts causing death of various age classes occur both on land and in the water. Many actions have been taken to address known negative impacts to loggerhead sea turtles. However, many remain unaddressed, have not been sufficiently addressed, or have been addressed in some manner but whose success cannot be quantified.

The SEFSC (2009) estimated the number of adult females in the NWA DPS at 30,000, and if a 1:1 adult sex ratio is assumed, the result is 60,000 adults in this DPS. Based on the reviews of nesting data, as well as information on population abundance and trends, NMFS and USFWS determined in the September 2011 listing rule that the NWA DPS should be listed as threatened. They found that an endangered status for the NWA DPS was not warranted given the large size of the nesting population, the overall nesting population remains widespread, the trend for the nesting population appears to be stabilizing, and substantial conservation efforts are underway to address threats.

In this Opinion, NMFS has considered the potential impacts of the proposed action on the NWA DPS of loggerhead sea turtles. Based on the average number of loggerhead sea turtles captured or impinged at OCNGS over the most recent 10 year period, no more than 6 loggerhead sea turtles are likely to be captured or impinged at OCNGS over the remaining term of the facility's operating license. Based on the mortality rate for loggerheads captured or impinged at the facility, no more than 1 of these turtles are likely to die as a result of interactions with the facility. Due to the difficulty in determining cause of death, it is assumed for the purposes of this analysis, that any dead loggerhead sea turtle captured or impinged at OCNGS was killed as a result of interactions with the facility. NMFS anticipates that on average, no more than 1 loggerhead sea turtle would be captured or impinged annually; however, as many as 3 loggerhead sea turtles have been captured at OCNGS in a given year and it is possible that there will be years where as many as 3 loggerheads will be captured and also likely that there will be years where no loggerhead sea turtles are captured. Live turtles captured at the facility may have minor injuries; however, they are expected to make a complete recovery without any impairment to future fitness. Capture at OCNGS will temporarily prevent these sea turtles from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the turtles are returned to the wild. The capture of live loggerhead sea turtles from the OCNGS intakes is not likely to reduce the numbers of loggerhead sea turtles in the action area, the numbers of loggerheads in any subpopulation or the species as a whole. Similarly, as the capture of live loggerhead sea turtles from the OCNGS intakes will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live loggerhead sea turtles from the OCNGS intakes is also not likely to affect the distribution of loggerhead sea turtles in the action area or affect the distribution of sea turtles throughout their range. As any effects to individual live loggerhead sea turtles removed from the intakes will be minor and temporary there are not anticipated to be any population level impacts.

The lethal removal of up to 1 loggerhead sea turtle from the action area over the remainder of the term of the operating license (i.e., through April 2029), would be expected to reduce the number of loggerhead sea turtles from the recovery unit of which they originated as compared to the number of loggerheads that would have been present in the absence of the proposed actions (assuming all other variables remained the same). However, this does not necessarily mean that these recovery units will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced. The final revised recovery plan for loggerheads compiled the most recent information on mean number of loggerhead nests and the approximated counts of nesting females per year for four of the five identified recovery units (i.e., nesting groups). They are: (1) for the NRU, a mean of 5,215 loggerhead nests per year with approximately 1,272 females nesting per year; (2) for the PFRU, a mean of 64,513 nests per year with approximately 15,735 females nesting per year; (3) for the DTRU, a mean of 246 nests per year with approximately 60 females nesting per year; and (4) for the NGMRU, a mean of 906 nests per year with approximately 221 females nesting per year. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit.

It is likely that the loggerhead sea turtles captured at OCNGS originate from several of the recovery units. Limited information is available on the genetic makeup of sea turtles in the mid-Atlantic, including Barnegat Bay. Cohorts from each of the five western Atlantic subpopulations are expected to occur in the action area. Genetic analysis of samples collected from immature loggerhead sea turtles captured in pound nets in the Pamlico-Albemarle Estuarine Complex in North Carolina from September-December of 1995-1997 indicated that cohorts from all five western Atlantic subpopulations were present (Bass et al. 2004). In a separate study, genetic analysis of samples collected from loggerhead sea turtles from Massachusetts to Florida found that all five western Atlantic loggerhead subpopulations were represented (Bowen et al. 2004). Bass et al. (2004) found that 80 percent of the juveniles and sub-adults utilizing the foraging habitat originated from the south Florida nesting population, 12 percent from the northern subpopulation, 6 percent from the Yucatan subpopulation, and 2 percent from other rookeries. The previously defined loggerhead subpopulations do not share the exact delineations of the recovery units identified in the 2008 recovery plan. However, the PFRU encompasses both the south Florida and Florida panhandle subpopulations, the NRU is roughly equivalent to the northern nesting group, the Dry Tortugas subpopulation is equivalent to the DTRU, and the Yucatan subpopulation is included in the GCRU.

Based on the genetic analysis presented in Bass et al. (2004) and the small number of loggerheads from the DTRU or the NGMRU likely to occur in the action area it is extremely unlikely that the loggerhead likely to be killed due to interactions with the OCNGS will originate from either of these recovery units. The majority, at least 80% of the loggerheads captured or impinged, are likely to have originated from the PFRU, with the remainder from the NRU and GCRU. As such, of the 6 loggerheads likely to be captured or impinged at the facility, 5 are expected to be from the PFRU, with 1 from the NRU or the GCRU. As explained above, only 1 loggerhead mortality is expected to result from the operation of the facility over the remainder of its operating license. As it is impossible to predict whether this turtle will be from the PFRU, the NRU or the GCRU, NMFS considers below the effects of the mortality of 1 loggerhead from any of the these three recovery units.

As noted above, the most recent population estimates indicate that there are approximately 15,735 females nesting annually in the PFRU and approximately 1,272 females nesting per year in the NRU. For the GCRU, the only estimate available for the number of loggerhead nests per year is from Quintana Roo, Yucatán, Mexico, where a range of 903-2,331 nests per year was estimated from 1987-2001 (NMFS and USFWS 2007a). There are no annual nest estimates available for the Yucatán since 2001 or for any other regions in the GCRU, nor are there any estimates of the number of nesting females per year for any nesting assemblage in this recovery unit; however, the 2008 recovery plan indicates that the Yucatan nesting aggregation has at least 1,000 nesting females annually. As the numbers outlined here are only for nesting females, the total number of loggerhead sea turtles in each recovery unit is likely significantly higher. The loss of 1 loggerhead represents an extremely small percentage of the number of sea turtles in the PFRU. Even if the total population was limited to 15,735 loggerheads, the loss of 1 individual would represent approximately 0.006% of the population. Similarly, the loss of 1 loggerhead from the NRU represents an extremely small percentage of the recovery unit. Even if the total population was limited to 1,272 sea turtles, the loss of 1 individual would represent approximately 0.08% of the population. The loss of 1 loggerhead from the GCRU, which is expected to support at least 1,000 nesting females, represents less than 0.1% of the population. The loss of such a small percentage of the individuals from any of these recovery units represents an even smaller percentage of the species as a whole. As such, it is unlikely that the death of one loggerhead sea turtle will have a detectable effect on the numbers and population trends of loggerheads in these recovery units or the number of loggerheads in the population as a whole. Additionally, this action is not likely to reduce distribution of loggerheads because the action will only result in temporary delays for foraging and migrating loggerheads and will not impede any loggerheads from accessing suitable foraging grounds and or disrupt other migratory behaviors.

In general, while the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species, this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of loggerhead sea turtles because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, and there are several thousand individuals in the population.

Based on the information provided above, the death of no more than 1 loggerhead sea turtle as a result of the ongoing operations of the OCNGS will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect loggerheads in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent loggerheads from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the death of 1 loggerhead represents an extremely small percentage of the species as a whole; (2) the loss of this loggerhead will not change the status or trends of any nesting aggregation, recovery unit or the species as a whole; (3) the loss of 1 loggerhead is not likely to have an effect on the levels of genetic heterogeneity in the population; (3) the loss of one loggerhead is likely to have an undetectable effect on reproductive output of any nesting aggregation or the species as a whole; and, (4) the action will have no effect on the distribution of loggerheads in the action area or throughout its range; and, (6) the action will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that loggerheads will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate.

Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action will not appreciably reduce the likelihood of survival of the loggerhead sea turtle species. Also, it is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of loggerheads in any geographic area and since it will not affect the overall distribution of loggerheads other than to cause minor temporary adjustments in movements in the action area. The proposed action will not utilize loggerheads for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect any of these species of sea turtles, or affect their continued existence. As explained above, the proposed action is likely to result in the mortality of up to 1 loggerhead over the remainder of the facility's operating license (i.e., through April 9, 2029); however, as explained above, the loss of this individual over this time period is not expected to affect the persistence of loggerhead sea turtles. In summary, the effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the action will not prevent the species from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because while the action may result in a small reduction in the number of loggerheads and a small reduction in the amount of potential reproduction due to the loss of one individual, these effects will be undetectable over the long-term and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not appreciably reduce the likelihood that loggerhead sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual loggerhead sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While NMFS is not able to predict with precision how climate change will continue to impact loggerhead sea turtles in the action area or how the species will adapt to climate-change related environmental impacts, no additional effects related to climate change to loggerhead sea turtles in the action area are anticipated over the life of the proposed action (i.e., through 2029). NMFS has considered the effects of the proposed action in light of cumulative effects explained above, including climate change, and has concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the mortality of no more than 1 loggerhead, is not likely to appreciably reduce the survival and recovery of the NWA DPS of loggerhead sea turtles.

Green sea turtles are listed as both threatened and endangered under the ESA. Breeding colony populations in Florida and on the Pacific coast of Mexico are considered endangered while all others are considered threatened. Due to the inability to distinguish between these populations away from the nesting beach, for this Opinion, green sea turtles are considered endangered wherever they occur in U.S. waters. Green sea turtles are distributed circumglobally and can be found in the Pacific, Indian, and Atlantic Oceans as well as the Mediterranean Sea (NMFS and USFWS 1991; Seminoff 2004; NMFS and USFWS 2007d). As is also the case with the other sea turtle species, green sea turtles face numerous threats on land and in the water that affect the survival of all age classes.

A review of 32 Index Sites distributed globally revealed a 48% to 67% decline in the number of mature females nesting annually over the last three generations (Seminoff 2004). For example, in the eastern Pacific, the main nesting sites for the green sea turtle are located in Michoacan, Mexico, and in the Galapagos Islands, Ecuador, where the number of nesting females exceeds 1,000 females per year at each site (NMFS and USFWS 2007d). Historically, however, greater than 20,000 females per year are believed to have nested in Michoacan alone (Cliffton *et al.* 1982; NMFS and USFWS 2007d). However, the decline is not consistent across all green sea turtle nesting areas. Increases in the number of nests counted and, presumably, the numbers of mature females laying nests were recorded for several areas (Seminoff 2004; NMFS and USFWS 2007d). Of the 32 index sites reviewed by Seminoff (2004), the trend in nesting was described as: increasing for 10 sites, decreasing for 19 sites, and stable (no change) for 3 sites. Of the 46 green sea turtle nesting sites reviewed for the 5-year status review, the trend in nesting was described as increasing for 12 sites, decreasing for 4 sites, stable for 10 sites, and unknown for 20 sites (NMFS and USFWS 2007d). The greatest abundance of green sea turtle nesting in the western Atlantic occurs on beaches in Tortuguero, Costa Rica (NMFS and USFWS 2007d). Nesting in the area has increased considerably since the 1970s and nest count data from 1999-

2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007d). One of the largest nesting sites for green sea turtles worldwide is still believed to be on the beaches of Oman in the Indian Ocean (Hirth 1997; Ferreira *et al.* 2003; NMFS and USFWS 2007d). However, nesting data for this area has not been published since the 1980s and updated nest numbers are needed (NMFS and USFWS 2007d).

The results of genetic analyses show that green sea turtles in the Atlantic do not contribute to green sea turtle nesting elsewhere in the species' range (Bowen and Karl 2007). Therefore, increased nesting by green sea turtles in the Atlantic is not expected to affect green sea turtle abundance in other ocean basins in which the species occurs. However, the ESA-listing of green sea turtles as a species across ocean basins means that the effects of a proposed action must, ultimately, be considered at the species level for section 7 consultations. NMFS recognizes that the nest count data available for green sea turtles in the Atlantic clearly indicates increased nesting at many sites. However, NMFS also recognizes that the nest count data, including data for green sea turtles in the Atlantic, only provides information on the number of females currently nesting, and is not necessarily a reflection of the number of mature females available to nest or the number of immature females that will reach maturity and nest in the future. Given the late age to maturity for green sea turtles (20 to 50 years) (Balazs 1982; Frazer and Ehrhart 1985; Seminoff 2004), caution is urged regarding the trend for any of the nesting groups since no area has a dataset spanning a full green sea turtle generation (NMFS and USFWS 2007d).

As described in the Status of the Species, Environmental Baseline and Cumulative Effects sections above, green sea turtles in the action area continue to be affected by multiple anthropogenic impacts including bycatch in commercial and recreational fisheries, habitat alteration and other factors that result in mortality of individuals at all life stages.

In this Opinion, NMFS has considered the potential impacts of the proposed action on green sea turtles. Based on the average number of green sea turtles captured or impinged at OCNGS over the most recent 12 year period, no more than 11 green sea turtles are likely to be captured or impinged at OCNGS over the remaining term of the facility's operating license. Based on the mortality rate for greens captured or impinged at the facility, no more than 2 of these turtles are likely to die as a result of interactions with the facility. Due to the difficulty in determining cause of death, it is assumed for the purposes of this analysis, that any dead green sea turtle captured or impinged at OCNGS was killed as a result of interactions with the facility. NMFS anticipates that on average, no more than 1 green sea turtle will be captured or impinged annually; however, as many as 3 green sea turtles have been captured at OCNGS in a given year and it is possible that there will be years where as many as 3 greens will be captured and also likely that there will be years where no green sea turtles are captured. Live turtles captured at the facility may have minor injuries; however, they are expected to make a complete recovery without any impairment to future fitness. Capture at OCNGS will temporarily prevent these sea turtles from carrying out essential behaviors such as foraging and migrating. However, these behaviors are expected to resume as soon as the turtles are returned to the wild. The capture of live green sea turtles from the OCNGS intakes is not likely to reduce the numbers of Kemp's ridley sea turtles in the action area, the numbers of green sea turtles in any subpopulation or the species as a whole. Similarly, as the capture of live green sea turtles from the OCNGS intakes will not affect the fitness of any individual, no effects to reproduction are anticipated. The capture of live green sea turtles from the OCNGS intakes is also not likely to affect the distribution of green sea turtles in the action area or affect the distribution of sea turtles throughout their range. As any effects to individual live green sea turtles removed from the intakes will be minor and temporary there are not anticipated to be any population level impacts.

The lethal removal of up to 2 green sea turtles from the action area over the remainder of the term of the operating license (i.e., through April 2029), would be expected to reduce the number of green sea turtles as compared to the number of green sea turtles that would have been present in the absence of the proposed actions (assuming all other variables remained the same). However, this does not necessarily mean that the species will experience reductions in reproduction, numbers or distribution in response to these effects to the extent that survival and recovery would be appreciably reduced.

The lethal removal of 2 green sea turtles, whether males or females, immature or mature animals, would reduce the number of green sea turtles as compared to the number of green that would have been present in the absence of the proposed action assuming all other variables remained the same; the loss of 2 green sea turtles represents a very small percentage of the species as a whole. Even compared to the number of nesting females (17,000-37,000), which represent only a portion of the number of greens worldwide, the mortality of 2 greens represents less than 0.011% of the population. The loss of these sea turtles would be expected to reduce the reproduction of green sea turtles as compared to the reproductive output of green sea turtles in the absence of the proposed action. As described in the "Status of the Species" section above, NMFS considers the trend for green sea turtles to be stable. However, as explained below, the death of up to 2 green sea turtles over the remainder of the operating license will not appreciably reduce the likelihood of survival for the species for the following reasons.

While generally speaking, the loss of a small number of individuals from a subpopulation or species may have an appreciable reduction on the numbers, reproduction and distribution of the species this is likely to occur only when there are very few individuals in a population, the individuals occur in a very limited geographic range or the species has extremely low levels of genetic diversity. This situation is not likely in the case of greens because: the species is widely geographically distributed, it is not known to have low levels of genetic diversity, there are several thousand individuals in the population and the number of greens is likely to be increasing and at worst is stable. This action is not likely to reduce distribution of greens because the action will not impede greens from accessing foraging grounds or cause more than a temporary disruption to other migratory behaviors.

Based on the information provided above, the death of up to 2 greens sea turtles will not appreciably reduce the likelihood of survival (i.e., it will not decrease the likelihood that the species will continue to persist into the future with sufficient resilience to allow for the potential recovery from endangerment). The action will not affect green sea turtles in a way that prevents the species from having a sufficient population, represented by all necessary age classes, genetic heterogeneity, and number of sexually mature individuals producing viable offspring and it will not result in effects to the environment which would prevent green sea turtles from completing their entire life cycle, including reproduction, sustenance, and shelter. This is the case because: (1) the species' nesting trend is increasing; (2) the death of 2 green sea turtles represents an extremely small percentage of the species as a whole; (3) the loss of 2 green sea turtles will not change the status or trends of the species as a whole; (4) the loss of 2 green sea turtles is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of 2 green sea turtles is likely to have an undetectable effect on reproductive output of the species as a whole; (6) the action will have no effect on the distribution of greens in the action area or throughout its range; and (7) the action will have no effect on the ability of loggerheads to shelter and only an insignificant effect on individual foraging loggerheads.

In certain instances an action may not appreciably reduce the likelihood of a species survival (persistence) but may affect its likelihood of recovery or the rate at which recovery is expected to occur. As explained above, NMFS has determined that the proposed action will not appreciably reduce the likelihood that green sea turtles will survive in the wild. Here, NMFS considers the potential for the action to reduce the likelihood of recovery. As noted above, recovery is defined as the improvement in status such that listing is no longer appropriate.

Section 4(a)(1) of the ESA requires listing of a species if it is in danger of extinction throughout all or a significant portion of its range (i.e., "endangered"), or likely to become in danger of extinction throughout all or a significant portion of its range in the foreseeable future (i.e., "threatened") because of any of the following five listing factors: (1) The present or threatened destruction, modification, or curtailment of its habitat or range, (2) overutilization for commercial, recreational, scientific, or educational purposes, (3) disease or predation, (4) the inadequacy of existing regulatory mechanisms, (5) other natural or manmade factors affecting its continued existence.

The proposed action will not appreciably reduce the likelihood of survival of green sea turtles. Also, it is not expected to modify, curtail or destroy the range of the species since it will result in an extremely small reduction in the number of Green sea turtles in any geographic area and since it will not affect the overall distribution of Green sea turtles other than to cause minor temporary adjustments in movements in the action area. The proposed action will not utilize Green sea turtles for recreational, scientific or commercial purposes, affect the adequacy of existing regulatory mechanisms to protect any of these species of sea turtles, or affect their continued existence. As explained above, the proposed action is likely to result in the mortality of up to 2 green sea turtles; however, as explained above, the loss of these individuals over this time period is not expected to affect the persistence of green sea turtles. The effects of the proposed action will not hasten the extinction timeline or otherwise increase the danger of extinction; further, the action will not prevent the species from growing in a way that leads to recovery and the action will not change the rate at which recovery can occur. This is the case because while the action may result in a small reduction in the number of greens and a small reduction in the amount of potential reproduction due to the loss of two individuals, these effects will be undetectable over the long-term and the action is not expected to have long term impacts on the future growth of the population or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not appreciably reduce the likelihood that green sea turtles can be brought to the point at which they are no longer listed as endangered or threatened.

Despite the threats faced by individual green sea turtles inside and outside of the action area, the proposed action will not increase the vulnerability of individual sea turtles to these additional threats and exposure to ongoing threats will not increase susceptibility to effects related to the proposed action. While NMFS is not able to predict with precision how climate change will continue to impact Green sea turtles in the action area or how the species will adapt to climate-change related environmental impacts, no additional effects related to climate change to Green sea turtles in the action area are anticipated over the life of the proposed action (i.e., through 2029). NMFS has considered the effects of the proposed action in light of cumulative effects explained above, including climate change, and has concluded that even in light of the ongoing impacts of these activities and conditions, the conclusions reached above do not change.

Based on the analysis presented herein, the proposed action, resulting in the mortality of no more than 2 green sea turtles over the remaining term of the operating license, is not likely to appreciably reduce the survival and recovery of this species.

CONCLUSION

After reviewing the best available information on the status of endangered and threatened species under NMFS jurisdiction, the environmental baseline for the action area, the effects of the proposed action, interdependent and interrelated actions and the cumulative effects, it is NMFS' biological opinion that the proposed action may adversely affect but is not likely to jeopardize the continued existence of the loggerhead, Kemp's ridley or green sea turtles. No critical habitat is designated in the action area; therefore, none will be affected by the proposed action.

In the Incidental Take Statement accompanying this Opinion (see page 79), NMFS has determined that removal of sea turtles from the water and transfer of these sea turtles to an appropriate STSSN facility (such as the MMSC) is necessary and appropriate to ensure that sea turtles are monitored, rehabilitated and treated as necessary and that they are released back into the wild at a suitable location. The effects of holding and transfer to the facility on listed species in the action area are outlined below.

Effects of holding and relocation to MMSC as required by the Incidental Take Statement

NMFS has estimated that up to 71 Kemp's ridley, 6 loggerhead, and 11 green sea turtles are likely to be impinged or captured at the OCNGS intakes over the remaining duration of the OCNGS operating license. While removal from the water, taking measurements, holding the sea turtles and transferring live turtles to a rehabilitation facility will cause stress and temporarily disrupt normal foraging and migratory behaviors, once released into the wild these turtles are likely to rapidly resume normal behaviors. Sea turtles are typically transferred to MMSC within a couple of hours of capture. Only 2 sea turtles (both Kemp's ridley) have died at MMSC after transfer from OCNGS and necropsies indicated that both sea turtles died from injuries and infection sustained prior to impingement at the intakes. NMFS has no information to suggest that the handling and transfer of sea turtles to a facility such as MMSC will have any significant adverse effects on sea turtles; in fact, all turtles transferred from OCNGS to MMSC, with the exceptions noted above, have been deemed healthy and ultimately returned to the wild. Removal of sea turtles from the water at the OCNGS intakes will ensure that these turtles are not subject to additional injury or eventual death at the intakes and that they will be released into the wild at a suitable location. Additionally, the transfer of sea turtles to an appropriate facility ensures that any sea turtles needing medical attention can be properly cared for. Two sea turtles removed from OCNGS have been eventually sent to a rehabilitation center in Topsail, North Carolina for surgery to repair injuries either sustained at OCNGS or prior to impingement. As such, NMFS believes that the removal of sea turtles from the water at OCGNS and the transfer of these turtles to an appropriate stranding facility will have a net beneficial effect to these turtles.

While the measuring of sea turtles will cause additional handling of these individuals and may cause stress, this is likely to be temporary and there are no known lasting effects of taking these measurements. The holding of sea turtles and transport to a stranding facility will temporarily disrupt normal foraging and migratory behaviors; however, once returned to the wild these turtles are likely to rapidly resume normal behaviors. As such, the holding, measuring, handling and transfer of live sea turtles is not likely to result in any additional adverse effects to these sea turtles. The handling, measuring and transfer of dead sea turtles will not have any additional effects on these turtles as they are already dead.

Kemp's ridley sea turtles
As noted above, NMFS has determined that the capture or impingement of up to 71 Kemp's ridley sea turtles over the remaining duration of the license, including the death of up to 26 of these turtles, is not likely to jeopardize the continued existence of this species. No additional deaths are likely to be attributable to measuring, handling or transfer. As explained above, the measuring, handling and transfer is not likely to cause any long lasting or significant adverse effects to these turtles and is likely to have a net beneficial effect.

Loggerhead sea turtles
As noted above, NMFS has determined that the capture or impingement of up to 6 loggerhead sea turtles over the remaining duration of the license, including the death of no more than 1 of these turtles, is not likely to jeopardize the continued existence of this species. No additional deaths are likely to be attributable to measuring, handling or transfer. As explained above, the measuring, handling and transfer is not likely to cause any long lasting or significant adverse effects to these turtles and is likely to have a net beneficial effect.

Green sea turtles
As noted above, NMFS has determined that the capture or impingement of up to 11 sea turtles over the remaining duration of the license, including the death of no more than 2 of these turtles, is not likely to jeopardize the continued existence of this species. No additional deaths are likely to be attributable to measuring, handling or transfer. As explained above, the measuring, handling and transfer is not likely to cause any long lasting or significant adverse effects to these turtles and is likely to have a net beneficial effect.

Conclusion of effects of holding and relocation

After reviewing the best available information on the status of endangered and threatened species under NMFS jurisdiction, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is NMFS' biological opinion that the monitoring, holding and relocation of sea turtles required by the Incidental Take Statement will have the beneficial effect of ensuring that these sea turtles are properly cared for and released back into the wild at a suitable location. Adding these procedures to the overall project is not likely to jeopardize the continued existence of the Kemp's ridley, loggerhead, or green sea turtles. Because no critical habitat is designated in the action area, none will be affected. NMFS has determined that the proposed action of renewing the operating license for the OCGNS and the measuring, holding and transfer of sea turtles as required by the Incidental Take Statement and the two actions together are not likely to jeopardize the continued existence of any threatened or endangered species. Overall, holding and relocation to an appropriate facility will be a net benefit to the sea turtles.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species of fish and wildlife. "Fish and wildlife" is defined in the ESA "as any member of the animal kingdom, including without limitation any mammal, fish, bird (including any migratory, nonmigratory, or endangered bird for which protection is also afforded by treaty or other international agreement), amphibian, reptile, mollusk, crustacean, arthropod or other invertebrate, and includes any part, product, egg, or offspring thereof, or the dead body or parts thereof." 16 U.S.C. 1532(8). "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS to include any act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. "Otherwise lawful activities" are those actions that meet all State and Federal legal requirements except for the prohibition against taking in ESA Section 9 (51 FR 19936), including any state endangered species laws or regulations. Section 9(g) makes it unlawful for any person "to attempt to commit, solicit another to commit, or cause to be committed, any offense defined [in the ESA.]" 16 U.S.C. 1538(g). See also 16 U.S.C. 1532(13). 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 under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by NRC so that they become binding conditions for the exemption in section 7(o)(2) to apply. NRC has a continuing duty to regulate the activity covered by this Incidental Take Statement. If NRC (1) fails to assume and implement the terms and conditions or (2) fails to require the operator, Exelon, to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms in the operating license, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, NRC or the applicant must report the progress of the action and its impact on the species to the NMFS as specified in the Incidental Take Statement [50 CFR §402.14(i)(3)] (See U.S. Fish and Wildlife Service and National Marine Fisheries Service's Joint Endangered Species Act Section 7 Consultation Handbook (1998) at 4-49).

Amount or Extent of Take

The OCNGS will continue to operate until April 2029 under the terms of the existing license issued by the NRC that became effective in April 2009. This action has the potential to directly affect Kemp's ridley, loggerhead and green sea turtles due to impingement at the CWS and DWS intakes and capture by plant personnel near the intakes. These interactions are likely to cause injury and/or mortality to the affected sea turtles. In addition, the removal of sea turtles from the water and transfer to a rehabilitation facility may cause stress and will disrupt the sea turtles normal foraging and migratory behaviors. Based on the distribution of sea turtles in the action area and information available on historic interactions between sea turtles and the OCNGS, NMFS anticipates that no more than NMFS has estimated that the proposed action will result in the capture or impingement of up to 71 Kemp's ridley sea turtles, 6 loggerhead sea turtles and 11 green sea turtles, inclusive of mortalities accounting for no more than 26 Kemp's ridleys, 1 loggerhead, and 2 green sea turtles. All of the sea turtles captured or impinged are likely to be injured due to interactions with the trash bars. While the handling of decomposed turtles or turtle parts is considered to be a take, NMFS is most concerned with the takes that appear to be fresh dead sea turtles and therefore directly attributable to the operation of the OCNGS. NMFS recognizes that previously dead sea turtles may become impinged on the intakes at OCNGS and that some number of dead sea turtles taken at the facility may not necessarily be related to the operation of the facility itself. Due to the difficulty in determining the cause of death of sea turtles found dead at the intakes and the inconsistency in the ability of NRC and the applicant to secure prompt necropsy results, the aforementioned anticipated level of take includes sea turtles that may have been dead prior to impingement on the OCNGS intakes. As explained in the "Effects of the Action" section, effects of the facility on sea turtle prey items and the effect of the discharge of pollutants, including chlorine and heat, will be insignificant or discountable. In the accompanying Opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to any sea turtle species.

In order to effectively monitor the effects of this action, it is necessary to examine the sea turtles that are captured at the facility. Monitoring provides information on the characteristics of the sea turtles encountered and may provide data which will help develop more effective measures to avoid future interactions with listed species. Additionally, as release of sea turtles back into the water at OCNGS is inappropriate as it would subject the sea turtles to additional stress and increase the likelihood of injury or mortality at the intakes, it is necessary to transfer the sea turtles to an appropriate STSSN facility. Currently, Exelon has an agreement with the MMSC where upon capturing a sea turtle at the facility, Exelon staff notifies MMSC and the turtle is transferred to MMSC care. NMFS believes that this procedure is necessary to effectively monitor the effects of the action and to ensure that the sea turtles are released back into the wild at an appropriate location. MMSC is authorized to care for, rehabilitate and release sea turtles pursuant to a Stranding Network Agreement and a permit issued by the USFWS pursuant to Section 10 of the ESA. As outlined below, NMFS is requiring NRC to ensure that Exelon continue this arrangement with MMSC or another appropriate STSSN approved and permitted facility. However, as the handling and transport of sea turtles may affect individuals by subjecting them to extended holding times and stress, the effects of this action have been considered in the accompanying Opinion. In the Opinion, NMFS has determined that no more than 71 Kemp's ridley sea turtles, 6 loggerhead sea turtles and 11 green sea turtles are likely to be directly affected by measuring, holding and transport. Reasonable and prudent measures and implementing terms and conditions requiring this monitoring and transport are outlined below.

Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of endangered and threatened sea turtles:

1. OCNGS must continue to implement a NMFS approved program to prevent, monitor, minimize, and mitigate the incidental take of sea turtles at the CWS and DWS intake structures.

2. All sea turtle impingements associated with the OCNGS and sea turtle sightings in the action area must be reported to NMFS.

3. All live sea turtles must be transported to an appropriate facility for necessary rehabilitation and release into the wild.

4. A necropsy of any dead sea turtles must be undertaken promptly to attempt to identify the cause of death, particularly whether the sea turtle died as a result of interactions with the intakes.

Terms and Conditions
In order to be exempt from prohibitions of section 9 of the ESA, Exelon must comply with, and NRC must ensure through enforceable terms of the operating license that Exelon does comply with, the following terms and conditions of the Incidental Take Statement, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary. Any taking that is in compliance with the terms and conditions specified in this Incidental Take Statement shall not be considered a prohibited taking of the species concerned (ESA Section 7(o)(2)).

1. To implement RPM #1, the CWS and DWS (when operational) intake trash bars must be cleaned daily from June 1 to October 31.

    a. Cleaning must include the full length of the trash rack, i.e., down to the bottom of each intake bay. To lessen the possibility of injury to a turtle, the raking process must be closely monitored so that it can be stopped immediately if a turtle is sighted.

    b. Personnel must be instructed to look beneath surface debris before the rake is used to lessen the possibility of injury to a turtle.

    c. Personnel cleaning the racks must inspect all trash that is dumped to ensure that no sea turtles are present within the debris.

    d. An alternative method of daily cleaning of the full length of the trash racks must be developed for use between June 1 through October 31 when the trash rake is unavailable due to necessary repair or maintenance or is otherwise inoperable. If the trash rake will be inoperable for more than 24 hours, Exelon or NRC must contact NMFS and explain what alternate arrangements have been made to ensure that the full length of the trash racks is cleaned at least once per 24 hours.

2. To implement RPM #1, inspection of CWS and DWS cooling water intake trash bars (and immediate area upstream) must continue to be conducted at least once every 4 hours (three times per 12-hour shift) from June 1 through October 31. NRC must ensure that inspections follow a set schedule so that they are regularly spaced rather than clumped. Inspections must occur at least three times during each 12 hour shift. A proposed schedule would be to schedule inspections 2 hours after the start of each shift and then every 4 hours during the shift. Times of inspections, including those when no turtles were sighted, must be recorded.

3. To implement RPM #1, lighting must be maintained at the intake bays to enable inspection personnel to see the surface of each intake bay and to facilitate safe handling of turtles which are discovered at night. Portable spotlights must be available at both the CWS and the DWS for times when extra lighting is needed.

4. To implement RPM #1, dip nets, baskets, and other equipment must be available at both the CWS and the DWS and must be used to remove smaller sea turtles from the OCNGS intake structures to reduce trauma caused by the existing cleaning mechanism. Equipment suitable for rescuing large turtles (e.g., rescue sling or other provision) must be available at OCNGS and readily accessible from the CWS and DWS.

5. To implement RPM #1, an attempt to resuscitate comatose sea turtles must be made according to the procedures described in Appendix II. These procedures must be posted in appropriate areas such as the intake bay areas for both the CWS and the DWS, any other area where turtles would be moved for resuscitation, and the CWS and DWS operator's office(s).

6. To implement RPM #2, OCNGS personnel must observe the canal area for sea turtles where and when possible (i.e., during the daylight hours). Any sea turtles sighted in the canal and in vicinity of OCNGS (not necessarily only near the intake structures) must be reported to NMFS within 24 hours of the observation (NMFS Section 7 Coordinator at (978) 281-9328 or FAX (978) 281-9394).

7. To implement RPM #2, if any live or dead sea turtles are taken at OCNGS, plant personnel must notify NMFS within 24 hours of the take (NMFS Endangered Species Coordinator at 978-281-9208). An incident report for sea turtle take (Appendix III) must also be completed by plant personnel and sent to the NMFS Section 7 Coordinator via FAX (978-281-9394) within 24 hours of the take. Every sea turtle must be photographed. Information in Appendix IV will assist in identification of species impinged. All sea turtles that are sighted within the vicinity of OCNGS (including the intake and discharge structures) must also be recorded, and this information must be submitted in the annual report.

8. To implement RPM #2, an annual report of incidental takes must be submitted to NMFS by January 1 of each year. This report will be used to identify trends and further

conservation measures necessary to minimize incidental takes of sea turtles. The report must include, as detailed above, all necropsy reports, incidental take reports, photographs (if not previously submitted), a record of all sightings in the vicinity of OCNGS, and a record of when inspections of the intake trash bars were conducted for the 24 hours prior to the take. The annual report must also include any potential measures to reduce sea turtle impingement or mortality at the intake structures. This annual report must also include information on arrangements made with a STSSN facility to handle sea turtles taken in the coming year. The report must also include all necropsy reports. At the time the report is submitted, NMFS will supply NRC and Exelon with any information on changes to reporting requirements (i.e., staff changes, phone or fax numbers, e-mail addresses) for the coming year.

9. To implement RPM #2, OCNGS personnel or NRC must notify NMFS when the OCNGS reaches 50% of the incidental take level for any species of sea turtle. At that time, NRC and NMFS will determine if additional measures are needed to minimize impingement at the CWS or DWS intake structures.

10. To implement RPM#2, in any year when the estimated annual level of take (lethal and non-lethal) is exceeded, NRC must work with NMFS to determine whether the additional take represents new information revealing effects of the action that may not have been previously considered.

11. To implement RPM #3, a stranding/rehabilitation facility with the appropriate ESA authority must be contacted immediately following any live sea turtle take. Appropriate transport methods must be employed following the stranding facilities protocols, to transport the animal to the care of the stranding/rehabilitation personnel for evaluation, necessary veterinary care, tagging, and release in an appropriate location and habitat.

12. To implement RPM #4, all dead sea turtles must be necropsied by qualified personnel. The OCNGS must coordinate with a qualified facility or individual to perform the necropsies on sea turtles impinged at OCNGS, prior to the incidental turtle take, so that there is no delay in performing the necropsy or obtaining the results. The necropsy results must identify, when possible, the sex of the turtle, stomach contents, and the estimated cause of death. Necropsy reports must be submitted to the NMFS Northeast Region with the annual review of incident reports or, if not yet available, within 60 days of the incidental take.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize and monitor the impact of incidental take that might otherwise result from the proposed action. Specifically, these RPMs and Terms and Conditions will ensure that Exelon continues to implement measures to reduce the potential of mortality for any sea turtles impinged at the OCNGS, to report all interactions to NMFS and to provide information on the likely cause of death of any sea turtles impinged at the facility. The discussion below explains why each of these RPMs and Terms and Conditions are necessary and appropriate to minimize or monitor the level of incidental take associated with the proposed action and how they represent only a minor change to the proposed action.

RPM #1 and Term and Conditions #1-6 are necessary and appropriate because they are specifically designed to ensure that all appropriate measures are carried out to prevent, monitor and minimize the incidental take of sea turtles at the OCNGS. These conditions ensure that the potential for detection of sea turtles at the intakes is maximized and that any sea turtles removed from the water are done so in a manner that minimizes the potential for further injury. The procedures and requirements outlined in RPM #1 and Term and Conditions #1-6 are only a minor change because they are not expected to result in any modifications to plant operations and any increase in cost is small. Additionally, these conditions are consistent with conditions in previous ITSs for the OCNGS and are part of the normal procedures at the facility.

RPM#2 and Term and Condition #6-10 are necessary and appropriate as ensure the proper handling and documentation of any interactions with listed species as well as the prompt reporting of these interactions to NMFS. This represents only a minor change as the implementation of these conditions is not anticipated to result in any increased cost, delay of the project or change in the operation of the facility. Additionally, these conditions are consistent with conditions in previous ITSs for the OCNGS and are part of the normal procedures at the facility.

RPM#3 and Term and Condition #11 are necessary and appropriate as the continued transfer of turtles removed from the water alive to an approved stranding/rehabilitiation center maximizes the likelihood that these turtles when returned to the wild will be healthy. Additionally, this ensures that any injured turtles can be cared for, reducing the potential impact of any injuries and reducing the potential for delayed mortality. This represents only a minor change as Exelon already maintains a relationship with MMSC to carry out these activities and this condition is consistent with conditions in previous ITSs for the OCNGS and is part of the normal procedures at the facility.

RPM#4 and Term and Condition #12 is necessary and appropriate to determine and document the likely cause of death for any sea turtle removed from the OCNGS intakes and whether the cause of death is attributable to the action under consideration in this Opinion. This represents only a minor change as Exelon already maintains a relationship with MMSC to carry out these activities and this condition is consistent with conditions in previous ITSs for the OCNGS and is part of the normal procedures at the facility.

CONSERVATION RECOMMENDATIONS

In addition to Section 7(a)(2), which requires agencies to ensure that all projects will not jeopardize the continued existence of listed species, Section 7(a)(1) of the ESA places a responsibility on all federal agencies to "utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered species." Conservation Recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. As such, NMFS recommends that the NRC consider the following Conservation Recommendations, including but not limited to, requiring them as elements of the licensee's Environmental Protection Plan:

1. The NRC should use its authorities to support the investigation of methods to increase lighting and visibility at all trash racks, and work with OCNGS to implement these methods. At present, with use of portable spotlights and current lighting visibility is limited to approximately 1 meter below the water surface. Improvement of visibility may allow personnel to detect sea turtles at the intakes sooner and minimize the chance of mortality.
2. The NRC should use its authorities to support tissue analysis of dead sea turtles removed from OCNGS to determine contaminant loads, including chlorine.
3. In conjunction with NMFS, the NRC should use its authorities to support a research program to determine whether the plant provides features attractive to sea turtles (e.g., concentration of prey around intake structures, heated discharge). This program should investigate habitat use, diet, and local and long-term movements of sea turtles. Use of existing mark/recapture and telemetry methods should be considered in Barnegat Bay and associated waterways.
4. The NRC should use its authorities to support underwater and surface videography or diving behavior telemetry studies of turtles at the intake bays, in the Forked River, in the Oyster Creek discharge canal, and in Barnegat Bay to determine how turtles use these waterways and their behavior in the intake bays. The surface videography could help identify sea turtles in Forked River prior to impingent in the intake structures.
5. The NRC should use its authorities to support investigations on the variable environmental conditions which may contribute to or result in increased sea turtle taking (e.g. temperature changes, wind direction, influx of prey). Increased monitoring during favorable conditions for sea turtle presence near OCNGS should result from the investigations.
6. NRC should use its authorities to support the review of historical benthic survey data to identify sea turtles prey density and distribution at various sites in the action area and associated waterways. This information would clarify the potential for sea turtle prey to be attracted to the intake structures or area around OCNGS during times when turtles are likely to be in the action area.
7. The NRC should use its authorities to support in-water assessments, abundance, and distribution surveys for sea turtles in Barnegat Bay, Forked River, and Oyster Creek. Information obtained from these surveys should include the number of turtles sighted, species, location, habitat use, time of year, and portions of the water column sampled.

REINITIATION OF CONSULTATION

This concludes formal consultation on the continued operation of the OCNGS pursuant to the license issued by NRC in April 2009. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may not have been previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species; 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 incidental take is *exceeded*, Section 7 consultation must be reinitiated immediately.

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APPENDIX I.

Incidental Take of Sea Turtles at Oyster Creek Nuclear Generating Station Intake Structures
January 1992 through October 2011

SEA TURTLE IMPINGEMENT

Date/Time	*Species*	*Status*	*Length**	*Weight*	*Location*	*Temp*	*Details*
6/25/1992 1250 hrs	Cc	Dead	35.5 cm SCL	9.6 kg	Impinged on DWS trash bars, found upon routine inspection	21.6 C	Several deep gashes on side, appeared to be boat propeller wounds. MMSC necropsy concluded cause of death from propeller wounds, before impingement.
9/9/1992 1800 hrs	Cc	Alive	46.7 cm SCL	19.1 kg	Impinged on CWS trash bars, found upon routine inspection	25.6 C	Small wound with scar tissue behind head. Released into discharge canal.
9/11/1992 1400 hrs	Cc	Alive	46.7 cm SCL	19.1 kg	Impinged on CWS trash bars, found upon routine inspection	26.2 C	Small wound with scar tissue behind head. Considered to be the same turtle found on 9/9/92. Taken to MMSC, tagged, and released into ocean near Brigantine, NJ.
10/26/1992 0300 hrs	Lk	Alive	32.0 cm SCL	5.7 kg	Impinged on CWS trash bars, found upon routine inspection. Head out of water pointing upward.	11.3 C	Turtle found alive, moving about normally. Two scars from slash-like wounds on plastron. Not sure how long present at intake structure, but may have been there between 3 and 8 hours. Turtle taken to MMSC in Brigantine, NJ, then to North Carolina, with eventual release into the ocean off NC on October 31, 1992.
10/17/1993 1200 hrs	Lk	Dead	26.0 cm SCL	3.0 kg	Impinged on DWS trash bars, found upon routine inspection	16.7 C	Turtle found limp, immobile, no apparent breathing and resuscitation efforts were unsuccessful. Minor scrape marks on plastron may have occurred during removal from intake area. Not sure how long present at intake structure, but may have been there between 4 and 8 hours. Necropsy by Dr. Morreale found that drowning likely cause of death (fresh dead, no obvious trauma, empty stomach).
6/19/1994 1330 hrs	Cc	Alive	36.8 cm SCL	9.8 kg	Found in CWS Bay #4, swimming freely upstream of the trash bars	27.3 C	Turtle found alive, moving about normally. Within 3-4 hours of capture, turtle taken to MMSC in Brigantine, NJ, tagged, and released offshore.
7/1/1994 1000 hrs	Lk	Dead	27.7 cm SCL	3.6 kg	Found in DWS Bay #5 upon routine cleaning	25.7 C	Turtle found limp, immobile, no apparent breathing, strong odor of decomposition, and resuscitation efforts were unsuccessful. Not sure how long present at intake structure, but intake bay was cleaned the previous afternoon. Turtle sent to Cornell for necropsy but the results have not been received to date.

7/6/1994 0640 hrs	Cc	Dead	61.4 cm SCL	40.4 kg	Found in DWS Bay #4 upon routine cleaning of dilution intakes	26.9 C	Turtle found limp, immobile, no apparent breathing and resuscitation efforts were unsuccessful. Three old deep scars or slash-like propeller wounds on turtle, decomposition of all 4 appendages, large notch along turtle's marginal scutes. Not sure how long present at intake structure, but trash bars were cleaned 6 to 8 hours earlier. Necropsy by MMSC (R. Schoelkopf) found that turtle likely died 1 to 2 days before arriving at OCNGS, probably due to a long term illness.
7/12/1994 2240 hrs	Lk	Dead	26.7 cm SCL	3.3 kg	Found in DWS Bay #4 upon routine cleaning of dilution intakes	28.4 C	Turtle found limp, immobile, no apparent breathing and resuscitation efforts were unsuccessful. Not sure how long present at intake structure, but may have been there for several hours. Turtle sent to Cornell for necropsy but the results have not been received to date.
9/4/1997 0318 hrs	Lk	Dead	48.8 cm SCL	18.1 kg	Found in DWS Bay #6 upon routine cleaning of dilution intakes	22.9 C	Turtle found limp, immobile, no apparent breathing and resuscitation efforts were unsuccessful. Two dorsal scutes had damage, but no prominent scars of slashlike wounds. Not sure how long present at intake structure, but may have been there for up to several hours.
8/18/1998 0959 hrs	Cc	Alive	50.8 cm SCL	22.4 kg	Found live while routinely inspecting CWS Bay #4, swimming freely upstream of the trash bars	26.9 C	Turtle found alive, moving about normally. A 12 foot 1/4" polypropylene rope with a bucket attached to one end was wrapped around the right front flipper, and the flipper was atrophied and partially decayed. OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Turtle taken to MMSC in Brigantine, NJ, then to Sea World in Orlando, FL, with eventual release into the ocean.
9/23/1999 0310 hrs	Lk	Alive	26.4 cm SCL	2.9 kg	Impinged on CWS trash bars, found upon routine inspection	19.6 C	Turtle found alive, moving about normally and with no apparent injury. OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Turtle taken to MMSC in Brigantine, NJ, then to Virginia State Aquarium, with eventual release into the ocean.
10/23/1999 0200 hrs	Cm	Dead	27.0 cm SCL	2.8 kg	Found in DWS Bay #4 upon routine cleaning of dilution intakes	17.1 C	Turtle found limp, immobile, no apparent breathing and resuscitation efforts were unsuccessful. OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Dilution trash racks were mechanically cleaned the previous day. Turtle sent to Cornell for necropsy, but results have not been received to date.
06/23/2000 0120 hrs	Cc	Alive	47.8cm SCL	17.2 kg	Found in front of trash bars in DWS Bay #1 intake	25.3 C	Live turtle very active and no visible wounds or injury. OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Transferred to MMSC in Brigantine NJ, with eventual release into the ocean.

7/2/2000 1500 hrs	Lk	Dead	27.3 cm SCL	3.2 kg	Found floating into the trash bars in DWS Bay #1 intake on routine inspection of dilution trash racks	25.6 C	Turtle found limp, immobile, no apparent breathing and resuscitation efforts were unsuccessful. Two dorsal scutes had superficial scrape marks. OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Dilution trash racks were mechanically cleaned the previous evening (2130 hrs). Turtle in freezer until necropsy can be completed.
8/3/2000 1525 hrs	Cm	Alive	29.2 cm SCL	3.4 kg	Found live in DWS Bay #4 intake upon routine inspection of dilution trash racks	28.8 C	Turtle found alive, moving about normally and with no apparent injury. Carapace covered in barnacles; several marginal scutes had dull grayish coloration (indicative of possible fungal infection). OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Dilution trash racks mechanically cleaned earlier the same day. Turtle taken to MMSC in Brigantine, NJ, then to the Topsail Island Rehab Center, NC, with eventual release into the ocean on October 12, 2000.
8/28/2000 0112 hrs	Lk	Alive	26.2 cm SCL	2.9 kg	Found live in DWS Bay #1 intake upon routine inspection of dilution trash racks	26.5 C	Turtle found alive, moving about normally and with no apparent injury. OCNGS was in 72% power operation with four circulating water pumps and 2 dilution pumps. Dilution trash racks cleaned previous day and inspected earlier same night of capture. Turtle taken to MMSC in Brigantine, NJ, then to the Topsail Island Rehab Center, NC, with anticipated eventual release into the ocean.
9/18/2000 1310 hrs	Cc	Alive	57.2 cm SCL	26.5 kg	Found live while routinely inspecting CWS intake trash rack Bay #4	20.4 C	Turtle found alive, moving normally with no apparent injury. Majority of dorsal surface covered in barnacles; few scutes partially peeled. OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Trash racks cleaned previous afternoon. Turtle taken to MMSC in Brigantine, NJ, and released into the ocean off Nags Head, NC in late September
7/8/2001 1430 hrs	Cm (juv)	Alive	26.7 cm SCL	2.3 kg	Found live while routinely inspecting CWS Bay #4	26.7 C	Turtle found alive, swimming freely in Bay #4, moving normally with no apparent injury. Dorsal surface had several barnacles. OCNGS was in full power operations with four circulating water pumps and 2 dilution pumps. Trash racks cleaned the previous afternoon. Turtle taken to Marine Mammal Stranding Center in Brigantine, NJ. After confirming health and tagged, turtle released into nearshore waters near Brigantine
7/22/2001 1744 hrs	Lk (juv)	Dead	26 cm SCL	2.9 kg	Impinged on DWS Bay #5 trash bars, found upon routine inspection	26.9 C	Turtle found with deep slice wound between head and carapace on left side of neck. OCNGS was in full power operation with four circulating water pumps and 2 dilution pumps. Trash racks cleaned at 330 hrs same day. Turtle in freezer until necropsy could be set up.
8/14/2001 0334 hrs	Lk	Dead	22.8 cm SCL; 21.4 cm SCW		Impinged on DWS Bay #6	27.8 C	Turtle appears fresh dead, no obvious prop wounds. Several scutes scraped on carapace centerline and posterior notch. Intake velocity was 73 cm/sec and OCNGS had 982 percent power generating capacity over previous 48 hrs. Trash racks cleaned at 245 hrs same day. Intake canal turbidity high.

6/29/2002 0200	Lk	Alive	25.4 cm SCL; 24.1 cm SCW	n/a	Found alive, swimming in CWS Bay #5 and #6 cooling water intake, upon routine inspection of trash racks. Removed with large dipnet.	26.2 C	Turtle alive and active, appears healthy. Fresh scar (?) on right side of carapace. OCNGS had 99.9% power. CWS trash racks cleaned ~4 hrs earlier (2200 6/28/02). Animal delivered to MMSC at 0455 hrs - wound determined to not be of significant concern (eating and appeared healthy). Turtle later died at MMSC, and necropsy performed. Found to be female, all tissues surrounding cracked area were necrotic
7/3/2002 0755	Lk	Alive	34 cm SCL; 32.5 cm SCW	6 kg	Found alive, swimming in front of DWS Bay #5 intake trash bars, upon routine inspection. Removed with dipnet.	28.2 C	Turtle alive and active, appears healthy. One small scrape <1 cm long on dorsal scute. OCNGS had 100% power. Screen last inspected 7-3-02 0500 hrs. Animal delivered to MMSC at 1015 hrs; was swimming and eating well. Tagged (monellear #SSL127) and released on July 9 near Brigantine, NJ.
9/24/2003 1455	Lk	Alive	31.1 cm SCL; 30.5 cm SCW	11.5 lbs	Found alive, in intake pipe at DWS Bay #6.	73 F	Turtle alive and active, appears healthy. One lateral scute chipped (old); 2 scrapes on ventral surface. OCNGS had 100% power. Screen last inspected 9-23-03 1345 hrs. Animal picked up by MMSC at 1745 hrs; healthy and active. Tagged and released on 9-25 near Brigantine, NJ.
10/24/2003 0850	Cm (juv)	Alive	36.2 cm SCL; 30.5 cm SCW	6.9 kg	Found alive, against CWS Intake Bay #4.	53 F (11.7 C)	Turtle alive and alert, appears healthy but a bit lethargic. One scraped dorsal scute and one chipped lateral scute. Heavy algal growth on carapace. OCNGS had 98% power. Screen last inspected 10-24-03 0500 hrs. Animal picked up by MMSC at 1030 hrs; healthy and active. Held at MMSC and then transferred to VMSM for rehab and eventual release.
7/4/2004 1215 hrs	Lk	Dead	26.5 cm SCL; 25 cm SCW	5.4 kg	Found dead upon routine cleaning at DWS Bay #4 trash racks	25.6 C (78 F)	Turtle fresh dead, no obvious prop wounds or other injuries. Minor scrape/bruising on plastron near centerline. OCNGS had 100% percent power generating capacity over previous 48 hrs. Trash racks cleaned at 0800 hrs same day. Delivered to MMSC for necropsy at 1500 hrs: female; all internal organs healthy/unremarkable; stomach of crab parts; lungs appeared normal but sank in salt water solution and felt compressed. Probable cause of death--suffocation.
7/11/2004 1422 hrs	Lk	Alive	23 cm SCL; 22 cm SCW	1.8 kg	Upon routine cleaning, found swimming upstream of DWS Bay #5 trash racks. Turtle surfaced and dove, and personnel retrieved the animal	81.5 F (27.5 C)	Turtle appeared in good condition. Some minor scrapes noted on ventral surface of carapace (plastron?). OCNGS had 100% power. Screen last inspected 7-11-04 at 1315 hrs. Animal taken to MMSC at 1623 hrs. Examined and released 2 days later off Brigantine, NJ.
7/16/2004 1100 hrs	Lk	Alive	28 cm SCL	3.1 kg	Found alive upon routine cleaning of DWS Bay #5 trash racks	76 F (22.4 C)	Turtle appeared in good condition. Some small scrapes noted on plastron. OCNGS had 100% power. Screen last inspected 7-16-04 at 0900 hrs. Animal taken to MMSC at 1300 hrs. Examined and released off Brigantine, NJ.
7/20/2004 1213 hrs	Lk	Dead	18.3 cm SCL	0.8 kg	Found dead upon routine cleaning of CWS Bay #1 trash racks	79.7 F (26.5 C)	Resuscitation attempted but unsuccessful. Small puncture wound 1.3 cm diameter in left rear surface of carapace. OCNGS had 100% power. Screen last inspected 7-19-04 at 2115 hrs. Taken to MMSC at 1000 on 7-21-04 for necropsy
8/7/2004 0900 hrs	Lk	Alive	27 cm SCL	3.2 kg	Found alive upon routine cleaning of DWS Bay #5 trash racks	72.8 F (22.7 C)	Turtle appeared healthy and moving normally. Small bruise noted on plastron and healed scar from previous injury on left side of head in front of eye. OCNGS had 100% power. Screen last inspected 8-7-04 at 0515 hrs. Animal taken to MMSC on 8-7-04. Examined and subsequently released into ocean off Brigantine, NJ. **EXCEEDED ITS**

9/11/2004 1010 hrs	Lk	Dead	22.3 cm SCL; 22.9 cm SCW	2.2 kg	Found dead upon routine cleaning of DWS Bay #5 trash racks	24.3 C	Bruising to plastron and undersides of all 4 flippers. Small puncture wound to base of neck. Healed prop cut to rear of carapace. Animal taken to MMSC, then to U of Penn for necropsy. **EXCEEDED ITS**
9/12/2004 2329 hrs	Lk	Alive	21 cm SCL; 19.5 cm CW	1.4 kg	Found alive upon routine cleaning of CWS #5 trash racks	24.9 C	Active and eating on its own. Bruising to plastron and undersides of all 4 flippers. Missing left front flipper (clean amputation). Small bump on beak area of head. Turtle was taken to the MMSC in Brigantine, NJ, where it was examined, measured, fed and held for observation prior to release. The turtle was transported to the VMSM for tagging and release. **EXCEEDED ITS**
9/23/2004 2145 hrs	Lk	Alive	24.2 cm SCL	1.9 kg	Found alive swimming in CWS Bay #3 cooling water intake, upon routine inspection of trash racks	21.9 C	Turtle appeared alert and responsive. Turtle was taken to the MMSC in Brigantine, NJ, where it was examined, measured, fed and held for observation prior to release. The turtle was transported to the VMSM for tagging and release. **EXCEEDED ITS**
7/4/2005 0905 hrs	Lk	Dead	23.2 cm SCL	1.4 kg	Found in DWS Bay #1 upon routine cleaning of dilution intakes	21.9 C	Turtle was found dead among . Turtle was taken to the MMSC in Brigantine, NJ, where it was examined, measured, the necropsy was preformed.- necropsy results: skill crushed by possible prop strike, right carapace near shoulder cracked possible prop or skeg wound. unable to determine if injuries were pre or post mortem. esophagus lined with black, gritty material. stomach and intestine empty. immature male
8/5/2005 0500 hrs	Lk	Alive	23.6 cm SCL	1.9 kg	Found alive swimming in CWS Bay #4 cooling water intake, upon routine inspection of trash racks.	28.2 C	Turtle appeared alert and responsive, wound observed on front left flipper. Turtle was taken to the MMSC in Brigantine, NJ, where it was examined, measured, fed and held for observation. The turtle was then sent to the Sea Turtle Rescue and Rehabilitiation Center in Topsail, NC for further rehab. On August 12, the turtle was trasported to the NC State Veterinary School for amputation of the wounded flipper. The turtle will undergo further rehab before being released
6/30/2006 1100 hrs	LK	Alive	27.3cm SCL, 25.8 cm SCW	3.5kg	Found among the vegetation and debris removed from Bay #1 of the DWS	25.6C	Active, scrapes on dorsal and ventral carapace. Transferred to MMSC and released on July 5.
7/17/2006 0935 hrs	LK	Alive	25.2 SCL, 24.00 SCW	2.63 kg	In water within Bay #5 of the DWS	26.7C	lethargic during tranport but became alert and responsive at MMSC. minor abrasions on carapace, plastron and head. severe bruising on neck and base of all four flippers. Abrasions and bruising on neck and flippers. Transferred to MMSC. Appears to be doing fine. tagged and released by MMSC on July 19
7/19/2006 2130hrs	LK	Alive	26.7 SCL, 24.8 SCW	3.2kg	Found among the vegetation and debris removed from Bay #1 of the CWS	28.1C	Algae on carapce and minor bruising on plastron. It was found late at night and was transferred to MMSC on 7/20 am. Released by MMSC on July 23
7/25/2006 0425hrs	LK	Dead	28.5cm SCL, 26cm SCW	3.3kg	Found dead among the vegetation and debris removed from Bay #4 of the DWS	27.9C	Dead and moderately decomposed. OC staff reported that several scutes broken, areas of brusing and crushing wounds to carapace and plastron. Necropsy conducted by MMSC - stomach and intestines full of crab claws and parts. moderately decomposed. carapace and plastron show evidence of being crushed, possibly post-mortem. carapace had a rough break and scutes peeling off. buried by MMSC
8/1/2006 0507hrs	CC	Alive	74 SCL, 65SWC	50.4kg	In water within Bay #1 of the CWS	29.4C	OC staff reported no visible wounds or bruising. numerous barnacles on carapace. transferred to MMSC - observed, doing well and released on August 2.
10/5/2006 0940hrs	CC	Alive	20.3 SCL		Found among the vegetation and debris removed from Bay #6 of the DWS	18.8C	dilution water intake bay 6 . Missing front right flipper but has scar tissue and is healed. Wound opened up from abrasion against trash rack. Transported to MMSC and then to Topsail for surgery to repair old wound.

8/9/2007 0925hrs	LK	alive	25.4cm	2.7kg	Found among the vegetation and debris removed from trash rack at Bay #4 of the CWS	27.9C	Alive and active. Transferred to MMSC - released into Atlantic Ocean by MMSC on same day
06-14-10 1715 hrs	Cc	alive	48.7cm SCL	44.6lb	DWS Bay 5	25.1C	alive and active. Several old and healing scrapes on the posterior of the carapace and plastron. Small amount of algal growth on the carapace. Transferred to MMSC and released by MMSC.
9/11/2009 1050 hrs	CM	alive	26.5SCL	5.4lb	on trash rack at Bay 4 DWS	18.7C	alive and active after retrieval from trash grates. Two minor shallow scarpaes on ventral surface. Tranported to MMSC released offshore Brigantine Island, NJ on September 18, 2009
9/16/2007 0803hrs	LK	alive	29.3cm	4.3kg	Found among the vegetation and debris removed from trash rack at Bay #4 of the DWS	21C	Alive and active. Turtle observed swimming near CWS earlier in morning, likely to be same turtle. Transferred to MMSC - released into Atlantic Ocean by MMSC on 9-20-07.
6/27/2008 0115 hrs	LK	alive	21.7cm SCL	3.4lb	In water at Bay 1 of CWS	25.6C	cooling water intake bay 1. alive with light scrape/bruise on ventral surface. Transported to MMSC at 5:15am same day. **Tagged by MMSC reported as active with no major injuries. Transported to MD and released by MMSC off a USCG vessel on 7/23/2008**
7/07/2008 0131 hrs	LK	alive	25.9 cm SCL	5.9lb	In water at Bay 3 of CWS	25C	cooling water intake bay 3. alive and active. Minor bruising on plastron and ventral surfaces of flippers. Transported to MMSC at 4:30 same day. **MMSC reported heavy barnacle load and abnormal bloodwork - treated with antibiotics. Transported to MD and released by MMSC off a USCG vessel on 7/23/2008**
7/27/2008 0101 hrs	LK	alive	20.7cm SCL	3.2 lb	In water at Bay 1 of CWS	27.6C	cooling water intake bay 1. observed prior to raking and removed with net. alive with 3 cm laceration partially healed on left rear flipper and 1 cm cut on left posterior of plastron near LRF. . Minor bruising on plastron and ventral surface of flippers. **Transported to MMSC same day. MMSC transferred to VAMSC on 8-4-08. released by VAQS on 8/26/08 in Cape Charles, VA.**
7/27/2008 0119 hrs	LK	alive	25.5cm SCL	5.4 lb	In water at Bay 1 of CWS	27.6F	cooling water intake bay 1. observed prior to raking and removed with net. Alive and alert with minor bruising on plastron and ventral surface of flippers. minor 1cm laceration on dorsal surface of LRF. RRF missing a portion of the tip - old healed injury. **Transported to MMSC same day. MMSC transferred to VAMSC on 08-04-08. released by VAQS on 8/26/08 in Cape Charles, VA.**
07/31/2008 1719 hrs	LK	alive	22.5cm SCL	3.4 lb	In water within Bay 6 of the DWS	27.1C	dilution water intake bay 6. lethargic with minor abrasions on skin, large barnacle embedded under LFF, 2 barnacles under right eye, few barnacles on carapace, minor bruising on plastron. **Transferred to MMSC on same day. MMSC transferred to VAMSC on 8-04-08. released by VAQS on 8/26/08 in Cape Charles, VA.**

09-12-2008 2112 hrs	LK	dead	24.5cm SCL	5lb	on trash rack Bay 6 of DWS	26.4C	found among debris on face of trash rack in dilution water intake bay 6. turtle severely decomposed and presumed dead prior to impingement -- racks had been cleaned 24 hours prior and inspected 4 hours prior. Partially curshed carapace and deep narrow slice wound. transferred to MMSC - determined death likely due to severe trauma to head and carapace indicative of propellor wound. MMSC buried turtle on beach.
6/23/2009 1010 hrs	LK	alive	30cm SCL	7.6lb	In water at Bay 5 of DWS	21.5C	turtle active and appears to be in good health. No visible injuries observed. Transferred to MMSC - released by MMSC into Ocean in NJ on same day
7/17/2009 1400 hrs	LK	dead	23.4cm SCL	6.5lbs	on trash rack Bay 5 of DWS	26.2C	observed in dilution water intake bay 5. 90% operation. Turtle was inactive and removed from water. Resuscitation was attempted. MMSC necropsy indicates that this was a female and multifocal hard nodules were present in the liver. MMSC could not rule out drowning as a cause of death but does state that the turtle was likely debilitated prior to encountering the plant. MMSC buried the turtle on Brignantine Island, NJ
7/23/2009 1250 hrs	LK	dead	24.7cm SCL	4.9lb	on trash rack Bay 6 of DWS	25.2C	turtle was inactive upon retrieval from the trash gates and resucitation was attempted. Turtle had no puncture wounds or signs of major injury but did have a 6.5cm long shallow scrape near midline. MMSC necropsy indicated froth in left lung and froth and blood clots in the righ tlung. MMSC indicated this was consitent with drowning. MMSC buried the turtle on Brigantine Island, NJ
8/5/2009	LK	alive	23cm SCL	3.9lb	In water at Bay #1of the CWS	29.4C	very active after retrieval from trash gates and appeared healthy with no signs of physical trauma. Transferred to MMSC and released.
8/15/2009 1825 hrs	LK	alive	30.7cm SCL	10.2lb	In water at Bay 1 of DWS	28.8C	active upon retrieval from water. No visible injuries. Turned over to MMSC. MMSC reported in excellent condition and released it that day
09-10-2009 1030 hrs	LK	alive	24.7cm SCL	4.8lb	In water Bay 6 DWS	19.7C	alive but lethargic - evidence of previous injury on carapace (10cm crack). Went to MMSC that day. Transferred to Riverhead for rehab due to deep wound (likely boat propellor)
9-25-2009 1420 hrs	LK	dead	21.4cm SCL	3.5lb	Found among the vegetation and debris removed from trash rack at Bay #6 of the DWS	22.8C	not active upon removal from intake bay - obviously dead. Necropsy was peformed at MMSC - likely dead 1-2 days with no obvious cause of death...no wounds or abnormalities upon necropsy. GI tract contained crab parts. Racks had been inspected 3 hrs prior to detection and cleaned 24 hours previously.

9-25-2009 1440 hrs	LK	alive but died shortly after removal from water	27cm SCL	6.1lb	In water Bay 6 DWS	22.8C	not active upon removal from intake bay but appeared to be alive. Resuscitation was attempted but no results achieved other than a small amount of water was drained from turtle. Turtle was dead when MMSC responded. Necropy indicates this was a female turtle and cause of death was drowning - fluid in lungs and lungs were compressed. digestive tract full of crab hard parts and bladder had a small amount of urine. abrasions on plastron and carapace.
10-07-2009 1100hrs	LK	alive but died at MMSC	31.6cm SCL	10.0lb	In water at Bay 6 DWS	20.1C	Active and alert when retrieved from intake bay. Transferred to MMSC on same day. MMSC noted bruising on flippers, bloodshot eyes and lethargy. Upon arrival at MMSC turtle was not eating and died within 3 days. Necropsy done at U Florida and cause of death determined to be pneumonia and septicemia
10-30-09 1730 hrs	LK	alive	26.4cm SCL	5.6lb	In water at Bay 4 CWS	14.9C	Fairly active upon removal from intake bay. Picked up by MMSC same day. MMSC reports animal was lethargic and cold. Skin was pink, turtle dehydrated with sunken eyes, algae on carapace, head and plastron. missing tips of RFF, LRF and RRF, small chip near rear tip of carapace, several small holes in carapace, few small barnacales. MMSC observed it eating very little and transported to Riverhead for rehab.
06-24-10 2155 hrs	Lk	alive	25.5cm SCL	4.9lbs	DWS Bay 6	26.9C	alive and active. Several small abrasions on plastron and carapce. Small amount of scarring on flippers. Transferred to MMSC and released by MMSC on 6-28-10
06-26-10 820hrs	Lk	alive	27.5cm SCL	8.2lb	CWS Bay 5	25.5C	alive and active. Minor gouges on ridge of carapace that are old and healing. Transferred to MMSC and released by MMSC on 6-28-10
07-03-10 0036 hrs	Lk	alive	31.8cm SCL	10.2lb	CWS Bay 5	25.9C	alive and active. Small scratches on carapace. Three old wounds partially healed. Transferred to MMSC and released by MMSC on 7-9-10
07-09-10 0025	Lk	dead	33cm SCL	13lb	DWS Bay 6	31.05C	dead. Scrapes on shell and small puncture wound in middle of chest. Necropsy report not yet available.
10/5/2010 0130 hrs	CM	alive	30.6cm SCL	7lb	CWS Bay 4	16.3C	alive and alert. Minor scrapes and bruises. Transferred to MMSC and relased on 10-6-10
10-05-10 0135	Lk	alive	33.6cm SCL	11.2lb	CWS Bay 4	16.3C	alive and alert. Minor scrapes and bruises. Transferred to MMSC and relased on 10-6-10
10-11-10 0030	CM	alive	28.8cm SCL	6.4lb	CWS Bay 5	18.4C	alive and alert. Small abrasion on nose and old healing scrapes on plastron. Transferrred to MMSC and released on 10-11-10
10-30-10 0403	CM	alive	26cm SCL		CWS Bay 1	15.1C	alive. No apparent injuries. Transferred to MMSC.
06-07-11 9:15 hrs	LK	alive	25.1 cm SCL	6.4 lb	DWS Bay 1	21.3C	alive and alert. Some bruising on plastron. Transferred to MMSC and released.
06-09-11 17:34 hrs	Lk	dead	21.5cm SCL	3.0 lb	DWS Bay 4	27.1C	dead. MMSC necropsy determined it was dead at time of impingement due to amount of decomp.

08-13-11 0:55 hrs	CM	alive	22.0 SCL	3.1 lbs	CWS Bay 5	28.8C	alive and active. Minor scrapes on plastron. Transferred to MMSC and released on 8-17-11
08-22-11 0:40 hrs	Lk	alive	32.7 cm SCL	10 lbs	CWS Bay 6	28.1C	alive and active upon removal from water. Lethargic upon arrival at MMSC. Bruising and scrapes on plastron. Transferred to MMSC and released on 8-24-11
08-27-11 0:30 hrs	Lk	alive	32.0 cm SCL	8.8 lbs	CWS Bay 1	28C	alive and active. Scrapes on plastron. Transferred to MMSC and released on 8-29-11
08-27-11 16:30 hrs	Lk	alive	32.0 cm SCL	11.2 lbs	DWS Bay 4	25.7C	alive and alert. Scrapes on plastron. Old scar on shell - small section of left rear flipper missing. Transferred to MMSCand released on 8-29
08-30-11 9:45 hrs	Cc	alive	61.4 cm SCL	81.4 lbs	CWS Bay 5	22.8C	alive and alert. Many barnacles on shell, neck and flippers. Right front flipper missing outer half and infected (pre-existing wound). Two severe bites on right front flipper. Tooth rakes from shark. Transferred to MMSC on Aug 30 at 12:45 then taken to VMSC for long term rehab
09-28-11 2:34 hrs	Lk	dead	24.8cm SCL	6.2lbs	DWS Bay 2	25.5C	dead. MMSC necropsy determined it was dead at time of impingement due to amount of decomp.

APPENDIX II

Handling and Resuscitation Procedures Sea Turtles Found at OCNGS

Handling:
Do not assume that an inactive turtle is dead. The onset of rigor mortis and/or rotting flesh are often the only definite indications that a turtle is dead. Releasing a comatose turtle into any amount of water will drown it, and a turtle may recover once its lungs have had a chance to drain. There are three methods that may elicit a reflex response from an inactive animal:

- Nose reflex. Press the soft tissue around the nose which may cause a retraction of the head or neck region or an eye reflex response.
- Cloaca or tail reflex. Stimulate the tail with a light touch. This may cause a retraction or side movement of the tail.
- Eye reflex. Lightly touch the upper eyelid. This may cause an inward pulling of the eyes, flinching or blinking response.

General handling guidelines:

- Keep clear of the head.
- Adult male sea turtles of all species other than leatherbacks have claws on their foreflippers. Keep clear of slashing foreflippers.
- Pick up sea turtles by the front and back of the top shell (carapace). Do not pick up sea turtles by flippers, the head or the tail.
- If the sea turtle is actively moving, it should be retained at the OCNGS until transported by stranding/rehabilitation personnel to the nearest designated stranding/rehabilitation facility. The rehabilitation facility should eventually release the animal in the appropriate location and habitat for the species and size class of the turtle. Turtles should not be released where there is a risk of re-impingement at OCNGS.

Sea Turtle Resuscitation Regulations: (50 CFR 223.206(d)(1))
If a turtle appears to be comatose (unconscious), contact the designated stranding/rehabilitation personnel immediately. Once the rehabilitation personnel has been informed of the incident, attempts should be made to revive the turtle at once. Sea turtles have been known to revive up to 24 hours after resuscitation procedures have been followed.

- Place the animal on its bottom shell (plastron) so that the turtle is right side up and elevate the hindquarters at least 6 inches for a period of 4 up to 24 hours. The degree of elevation depends on the size of the turtle; greater elevations are required for larger turtles.
- Periodically, rock the turtle gently left to right and right to left by holding the outer edge of the shell (carapace) and lifting one side about 3 inches then alternate to the other side.
- Periodically, gently conduct one of the above reflex tests to see if there is a response.
- Keep the turtle in a safe, contained place, shaded, and moist (e.g., with a water-soaked towel over the eyes, carapace, and flippers) and observe it for up to 24 hours.
- If the turtle begins actively moving, retain the turtle until the appropriate rehabilitation personnel can evaluate the animal. The rehabilitation facility should eventually release the animal in a manner that minimizes the chances of re-impingement and potential harm to the animal (i.e., from cold stunning).
- Turtles that fail to move within several hours (up to 24) should be transported to a suitable facility for necropsy (if the condition of the sea turtle allows).

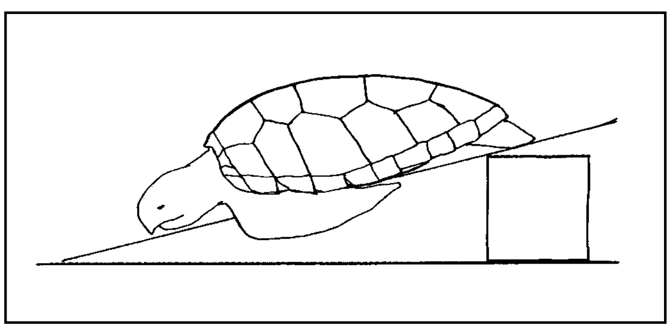
APPENDIX II, continued **(Handling and Resuscitation Procedures)**

Stranding/rehabilitation contact in New Jersey:
Bob Schoelkopf, Marine Mammal Stranding Center
P.O. Box 773
Brigantine, NJ
(609-266-0538)

Special Instructions for Cold-Stunned Turtles:

Comatose turtles found in the fall or winter (in waters less than 10□C) may be "cold-stunned". If a turtle appears to be cold-stunned, the following procedures should be conducted:

- Contact the designated stranding/rehabilitation personnel immediately and arrange for them to pick up the animal.
- Until the rehabilitation facility can respond, keep the turtle in a sheltered place, where the ambient temperature is cool and will not cause a rapid increase in core body temperature.



APPENDIX III

Incident Report of Sea Turtle Take - OCNGS

Photographs should be taken and the following information should be collected from all turtles (alive and dead) found in association with the OCNGS. Please submit all necropsy results (including sex and stomach contents) to NMFS upon receipt.

Observer's full name:____
Reporter's full name:____

Species Identification (Key attached):_____________________________________

Site of Impingement (CWS or DWS, Bay #, etc.):_______________________________

Date animal observed:_________________ Time animal observed: _________________________
Date animal collected:_________________ Time animal collected:__________________________
Date rehab facility contacted: _________________ Time rehab facility contacted: ______________
Date animal picked up: ______________________ Time animal picked up: ___________________

Environmental conditions at time of observation (i.e., tidal stage, weather):
____
____

Date and time of last inspection of screen:_______________________________________
Water temperature (□C) at site and time of observation:__________________________
Number of pumps operating at time of observation:_____________________________________
Average percent of power generating capacity achieved per unit at time of observation:________
Average percent of power generating capacity achieved per unit over the 48 hours previous to observation:____

Sea Turtle Information: *(please designate cm/m or inches)*

Fate of animal (circle one): dead alive
Condition of animal (*include comments on injuries, whether the turtle is healthy or emaciated, general behavior while at OCNGS*):____
____
____
____*(please complete attached diagram)*

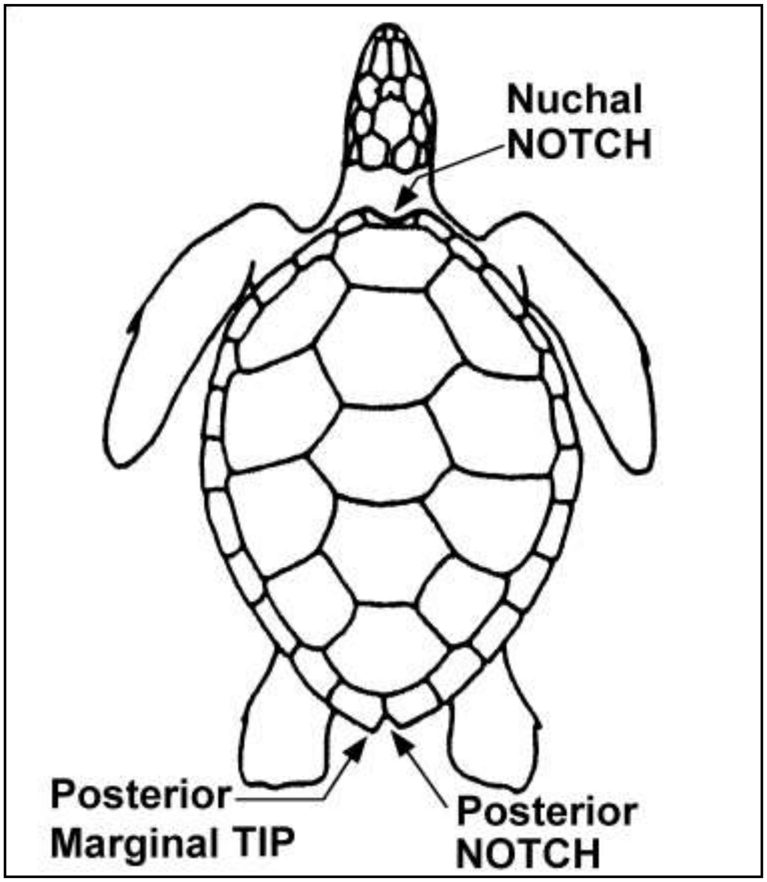
Carapace length - Curved:________________Straight:_________________
Carapace width - Curved:_________________Straight:_________________

Existing tags?: YES / NO *Please record all tag numbers.* Tag # ______________________
Photograph attached: YES / NO

(please label *species, date, location of impingement* on back of photograph)

APPENDIX III, continued **(Incident Report of Sea Turtle Take)**

Draw wounds, abnormalities, tag locations on diagram and briefly describe below.



Description of animal:

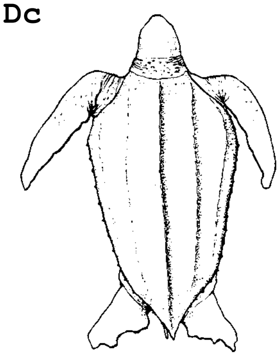
All information should be sent to the following address:
National Marine Fisheries Service, Northeast Region
Protected Resources Division
Attention: Endangered Species Coordinator
55 Great Republic Drive
Gloucester, MA 01930
Phone: (978) 281-9328
FAX: (978) 281-9394

APPENDIX IV

Identification Key for Sea Turtles Found in Northeast U.S. Waters

SEA TURTLES

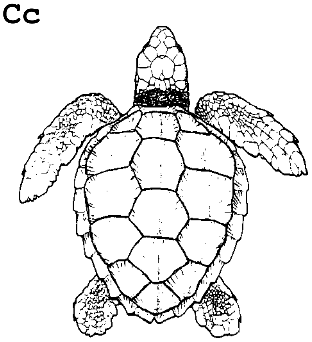
Dc



Leatherback (*Dermocheyls coriacea*)

Found in open water throughout the Northeast from spring through fall. Leathery shell with 5-7 ridges along the back. Largest sea turtle (4-6 feet). Dark green to black; may have white spots on flippers and underside.

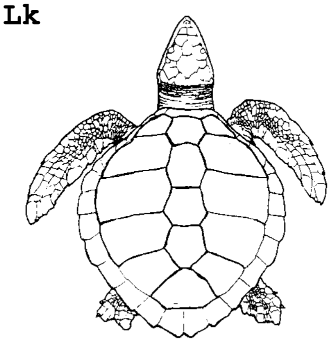
Cc



Loggerhead (*Caretta caretta*)

Bony shell, reddish-brown in color. Mid-sized sea turtle (2-4 feet). Commonly seen from Cape Cod to Hatteras from spring through fall, especially in southern portion of range. Head large in relation to body.

Lk



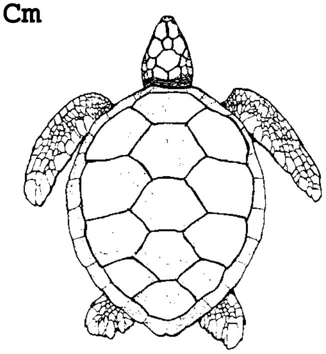
Kemp's ridley (*Lepidochelys kempi*)

Most often found in Bays and coastal waters from Cape Cod to Hatteras from summer through fall. Offshore occurrence undetermined. Bony shell, olive green to grey in color. Smallest sea turtle in Northeast (9-24 inches). Width equal to or greater than length.

APPENDIX IV, continued (**Identification Key**)

SEA TURTLES

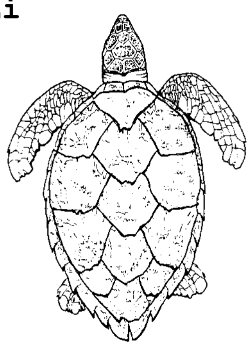
Cm



Green turtle (*Chelonia mydas*)

Uncommon in the Northeast. Occur in Bays and coastal waters from Cape Cod to Hatteras in summer. Bony shell, variably colored; usually dark brown with lighter stripes and spots. Small to mid-sized sea turtle (1-3 feet). Head small in comparison to body size.

Ei



Hawksbill (*Eretmochelys imbricata*)

Rarely seen in Northeast. Elongate bony shell with overlapping scales. Color variable, usually dark brown with yellow streaks and spots (tortoise-shell). Small to mid-sized sea turtle (1-3 feet). Head relatively small, neck long.