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, shutdown, and ongoing decommissioning
GAR-2019-01287

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

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Approved by: Jennifer Anderson

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1. 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) as well as the 2018 permanent shutdown and ongoing decommissioning of the facility.

This Opinion is based on information provided in NRC's April 2019 request for reinitiation, information submitted by NRC between April 2019 and February 2020, the 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 as cited herein. A complete administrative record of this consultation will be kept on file at the NMFS Greater Atlantic Regional Fisheries Office, Gloucester, Massachusetts.

2. BACKGROUND AND CONSULTATION HISTORY

The OCNGS began commercial operation in 1969 under the terms of a license that expired in 2009. A subsequent license was issued on April 8, 2009, authorizing an additional 20 years of operations. However, the facility ceased operations in September 2018 and is in the process of decommissioning. A number of consultations have been completed between NMFS and NRC to consider effects of project operations. A complete history of those consultations is included in our most recent Biological Opinion from November 2011. That Opinion, like all of the previous opinions, concluded that the continued operation of the facility was likely to adversely affect, but not likely to jeopardize, green, loggerhead, or Kemp's ridley sea turtles. There is no critical habitat in the action area.

On November 21, 2011, we issued a biological opinion considering the effects of the continued operation of Oyster Creek under the terms of Renewed Facility Operating License No. DPR-16, issued by the NRC to Exelon Generation Company, LLC. In that consultation, we considered effects of operation of OCNGS over the 20-year duration of the operating license (i.e., until April 2029). The Opinion included an Incidental Take Statement (ITS) that exempted the take (capture/collect) of 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. On July 26, 2018, Exelon personnel captured a seventh loggerhead at Oyster Creek since the biological opinion was issued, exceeding the amount of incidental take exempted for loggerhead sea turtles.[1] No additional loggerhead sea turtles have been collected since that date. The exceedance of the ITS requires reinitiation of the 2011 consultation. Additionally, on September 17, 2018, Exelon permanently ceased power generation at Oyster

[1] On July 26, 2018, plant personnel captured a seventh loggerhead at Oyster Creek since the 2011 biological opinion was issued. The individual was a live adult exhibiting older thoracic injuries. The turtle was transferred to the Marine Mammal Stranding Center in Brigantine, New Jersey, for treatment. Marine Mammal Stranding Center staff later euthanized the turtle due to the extent of its injuries; the injuries were not determined to be related to station operations.

Creek. The shutdown and decommissioning of the facility will cause different effects to listed species than those considered in the 2011 Opinion. Therefore, reinitiation of consultation is appropriate. This Opinion completes reinitiation to close out both issues.

NRC submitted a request to reinitiate consultation on April 30, 2019, a revised description of the proposed action on August 2, 2019, and additional supplemental and clarifying information through February 3, 2020.

3. DESCRIPTION OF THE ACTION

This biological opinion completes reinitiation of the consultation that considered effects of the continued operation of the Oyster Creek Nuclear Generating Station under the terms of the 2009 license and assesses effects of the shut down and decommissioning of the facility. Such a future consultation to consider decommissioning was contemplated in the 2011 biological opinion.

Operation of the facility occurred consistent with the action described in the 2011 Opinion until September 17, 2018 when commercial operations ceased. A summary of OCNGS operations is provided below (section 3.1). Operation of the facility following the cessation of commercial electric generation activities is described in section 3.2 and 3.3.

3.1 Summary 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. When the plant was operational, the flow direction in the intake canal west of the South Branch of the Forked River was reversed, and flowed toward the OCNGS.

OCNGS was shut down in September 2018 and the Circulating Water System (CWS) and Dilution Water System (DWS) are no longer used. The summary of OCNGS operations presented below describes plant operations prior to shutdown.

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 1,740 m^3/min of water [460,000 gallons per minute (gpm)]. The maximum

permissible average intake velocity for water approaching the CWS intake ports is 2.2 fps and the average was approximately [1 foot per second (fps)]. The maximum daily effluent temperature for cooling water discharge back to the discharge canal is 41.1°C (106°F).

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 (87 °F), 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 (2.4 fps). 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. During the operational period, personnel cleaning the CWS and DWS intake trash racks from June to October observed the trash rake during the cleaning operation so that the rake may be stopped if a sea turtle is sighted. The trash bars were 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 for sea turtles. 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.

In addition to the license issued by NRC, the facility also is subject to the terms of a Pollutant Discharge Elimination System permit issued by the State of New Jersey[2]. The most recent

[2] 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.

NJPDES permit was issued in December 2011 and was effective in April 2012; the previous permit was issued in 1994.

The 2012 NJPDES permit includes a number of limits for pollutants discharged from the facility as well as monitoring, record-keeping, and reporting requirements. The permit also contains thermal limits and monitoring requirements for the discharge of heated effluent, and requirements to minimize impingement and entrainment effects while the once-through cooling system is operational[3].

3.2 Background Information on Shut Down and Decommissioning Activities

For nuclear power reactors, the decommissioning process begins when a licensee decides to permanently cease operations. The major steps that make up the reactor decommissioning process are: certification to the NRC of permanent cessation of operations and removal of fuel; submittal and implementation of the post-shutdown decommissioning activities report (PSDAR); submittal of the license termination plan (LTP); implementation of the LTP; and, completion of decommissioning. General process information in this section is summarized from information available on NRC's webpage regarding decommissioning[4].

Notification: When the licensee has decided to permanently cease operations, it is required to submit a written notification to the NRC and must provide certification to the NRC in writing once fuel has been permanently removed from the reactor vessel.

Post-Shutdown Decommissioning Activities Report (PSDAR): No later than two years after cessation of operations, the licensee must submit a PSDAR to the NRC and a copy to the affected State(s). The PSDAR must include:

- a description and schedule for the planned decommissioning activities;
- an estimate of the expected costs; and,
- a discussion that provides the means for concluding that the environmental impacts associated with the decommissioning activities will be bounded by appropriate, previously issued environmental impact statements (EISs).

License Termination Plan (LTP): Each power reactor must submit an application for termination of its license at least two years before the license termination date. The LTP is approved by license amendment.

The LTP must include the following:

- a site characterization;
- identification of remaining dismantlement activities;
- plans for site remediation;
- detailed plans for the final radiation survey;
- a description of the end use of the site, if restricted;
- an updated site-specific estimate of remaining decommissioning costs; and

3 The 2011 NJPDES permit is available at: https://www.state.nj.us/dep/dwq/pdf/oystercreekfinalpermit.pdf; last accessed Feb 27, 2020.

4 https://www.nrc.gov/waste/decommissioning/process.html Last accessed: January 21, 2020

- a supplement to the environmental report describing any new information or significant environmental change associated with the licensee's proposed termination activities; and,
- identification of parts, if any, of the facility or site that were released for use before approval of the LTP.

Implementation of the License Termination Plan: After approval of the LTP, the licensee or responsible party must complete decommissioning in accordance with the approved LTP. The NRC staff will periodically inspect the decommissioning operations at the site to ensure compliance with the LTP. These inspections will normally include in-process and confirmatory radiological surveys. Decommissioning must be completed within 60 years of permanent cessation of operations, unless otherwise approved by the Commission.

Completion of Decommissioning: At the conclusion of decommissioning activities, the licensee will submit a final status survey report (FSSR) that documents the final radiological conditions of the site, and request that the NRC either: terminate the 10 CFR Part 50 license; or if the licensee has an Independent Spent Fuel Storage Installation (ISFSI), reduce the 10 CFR Part 50 ~~license~~ boundary to the footprint of the ISFSI. The NRC will approve the FSSR and the licensee's request if it determines that the licensee has met both of the following conditions: the remaining dismantlement has been performed in accordance with the approved LTP; and, the final radiation survey and associated documentation demonstrates that the facility and site are suitable for release in accordance with the LTR.

3.3 Oyster Creek Shutdown and Decommissioning Activities

As described below, the facility ceased operations in 2018. All shutdown and decommissioning activities are planned for completion by the end of 2035 at which point NRC will terminate the project license.

By letter dated February 14, 2018 (ML18045A084), Exelon submitted to NRC a certification in accordance with Sections 50.82(a)(1)(i) of Title 10 of the Code of Federal Regulations (10 CFR), indicating that it planned to cease permanent operation no later than October 31, 2018. By letter dated September 25, 2018 (ML18268A258), Exelon submitted to the NRC a certification in accordance with 10 CFR 50.82(a)(1)(ii), stating that Oyster Creek permanently ceased power operations on September 17, 2018, and that, as of September 25, 2018, all fuel had been permanently removed from the Oyster Creek reactor vessel.

Exelon submitted the Oyster Creek Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC on May 21, 2018. In the PSDAR, Exelon stated its intention to move all of the spent nuclear fuel into dry cask storage by the end of 2024 and put the plant into SAFSTOR (a method of decommissioning in which a nuclear facility is placed and maintained in a condition that allows the facility to be safely stored and subsequently decontaminated (deferred decontamination) to levels that permit release for unrestricted use) until it is ready to fully decommission the facility starting in 2075. This initial plan was revised to an accelerated timeline as described in the following paragraphs.

On August 31, 2018, Exelon and Holtec submitted a License Transfer Application (LTA) requesting NRC approval to transfer the Oyster Creek Renewed Facility Operating License and

the General License for the Oyster Creek Independent Spent Fuel Storage Installation (ISFSI) to Oyster Creek Environmental Protection, LLC (OCEP), as the licensed owner and to Holtec Decommissioning International (HDI), as the licensed operator. As noted above, on September 17, 2018, Exelon ceased generating electricity at the facility. In a September 25, 2018, letter to NRC, Exelon certified that all fuel had been removed from the reactor. The license transfer was approved by NRC staff and became effective on July 1, 2019.

Along with its August 31, 2018, license transfer application, Holtec submitted a revised Post-Shutdown Decommissioning Activities Report (PSDAR) to the NRC (replacing the PSDAR submitted by Exelon in May 2018. In the revised PSDAR, Holtec sets forth a schedule for the prompt decommissioning of Oyster Creek and unrestricted release of all portions of the site (excluding the ISFSI) within eight years after license transfer. Rather than a shutdown and decommissioning period that would extend to 2080, Holtec has proposed a schedule that would complete all shutdown and decommissioning activities by 2035. Termination of the project license by NRC is expected to take place by 2035.

Between September and December 2018, Exelon defueled the reactor and transferred all spent fuel to the spent fuel pool (SPF). The NRC issued Amendment No. 295 to the Oyster Creek renewed facility operating license on October 26, 2018, which revised the license and the associated technical specifications to permanently defueled technical specifications consistent with the permanent cessation of operations and permanent removal of fuel from the reactor vessel. During the ongoing initial decommissioning phase, Holtec will also drain fluids and de-energize reactor systems; reconfigure the electrical distribution, ventilation, heating, and fire protection systems; and perform other minor deconstruction activities. Holtec may also reconfigure systems required to operate the SFP. During the initial decommissioning period (expected to continue through June 2023), Oyster Creek will continue to withdraw up to 12,000 gpm[5] of water from the Forked River through the Circulating Water System (CWS) intake at an intake velocity of 0.02 feet per second (fps) or less for purposes of providing cooling water to the SFP. The water will be withdrawn using the Service Water (SW) or Emergency Service Water (ESW) systems.

During the time that fuel remains in the SFP, the fuel decay heat is removed by Fuel Pool Cooling system to the closed cooling water (CCW) system utilizing heat exchanges. CCW system heat is removed by SW or ESW system flow through additional heat exchangers. There is no communication of water between SFP water and the CCW system. There is no communication of water between the CCW and SW or ESW systems. . SW system water withdrawals from the intake canal have reduced to approximately 6,000 gpm. The water is returned to the discharge canal at a continuous flow rate of approximately 6,000-gpm or less. The intake and discharge temperature are monitored as required by the station's NJPDES permit, and based on the canal monitoring in 2019, the temperature rise of the SW system discharged to the canal averages approximately a 2.5°F. This discharge and associated heat load will continue to decrease until all fuel is removed from the SFP.

Spent fuel could remain in the SFP through the second quarter of 2023, at which time Holtec

[5] Permittee is authorized in the current NJPDES permit to withdraw the greater of up to 40,000 gpm or the flow commensurate with that achievable using closed-cycle cooling.

will have completed transfer all spent fuel from the SFP to onsite dry storage. Following this transfer, Holtec will drain and de- energize the SFP and its supporting systems, and all cooling water withdrawals from the Forked River will cease[6]. The spent fuel will remain in dry storage until it is transferred to the U.S. Department of Energy (DOE) for final disposal.

Decommissioning, including large component removal and decontamination, will begin in 2020 and continue through mid-2025. Holtec may ship dismantled large plant components and other wastes and materials by barge from an existing barge landing at the north bank of Oyster Creek immediately east of U.S. Highway 9. The licensee has periodically used this barge landing during both the construction and operation periods to transport large components to and from the site. As indicated in its June 11, 2019, responses to the NMFS' requests for additional information, the NRC staff assumes that barge vessel traffic associated with the proposed action would occur during the large component removal phase of the decommissioning period. The barge landing contains no permanently installed equipment or infrastructure, and Holtec anticipates that none would be needed to support barge traffic and loading associated with decommissioning. Holtec has indicated that it may require up to eight barge loads to remove dismantled large components from the site. Additionally, the company may use barge vessels to transport other shipments during decommissioning as well. In total, Holtec estimates at least eight and up to 100 barge vessels may travel to and from the Oyster Creek site in association with decommissioning activities beginning in 2021 and continuing through 2025. These barge trips will transport large components off site; however, in response to an inquiry from us, NRC has reported that the destinations and travel routes of any barges outside of Barnegat Bay are unknown.

Based on the current conditions in Oyster Creek and Barnegat Bay, Holtec does not anticipate that dredging would be necessary to support barge vessel traffic. However, if barging is selected as a transportation method, Holtec will further evaluate canal and bay conditions prior to 2021 and may determine that dredging is necessary. Accordingly, the NRC staff conservatively assumes that dredging would be required to allow for vessel traffic and included a one-time dredge event in the description of the proposed action that accompanied the request for consultation. The NRC staff assumes that dredging would take place in 2020 and that dredging would only occur once because all barge shipments would take place within five years following dredging. Based on information on past dredging within the area, five years is not enough time for sediment to build up to a degree that would necessitate further dredging. If undertaken, dredging would occur in Oyster Creek between the barge landing and Barnegat Bay to an unknown depth, and dredging may be required in Barnegat Bay itself to allow passage of loaded barges between the mouth of Oyster Creek and Barnegat Inlet. The NRC staff assumes that cutterhead (i.e., suction) dredging would be performed because this is the method of dredging that has been undertaken in the past and is expected to be an appropriate method given sediment type, location, and water depths. The Army Corps of Engineers last completed dredging in the Forked River, Oyster Creek, and Barnegat Bay channels in the fall of 2017 to restore navigational depths following Superstorm Sandy. Approximately 135,000 cubic yards of material was removed with cutterhead dredges. Any dredging would require Holtec to obtain U.S. Army Corps of Engineers and appropriate New Jersey Department of Environmental

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[6] SW or ESW flows may continue as necessitated Off Site Dose Calculation Manual (ODCM) NRC approved requirements for discharging processed water.

Protection, Division of Land Use Regulation, permits. Holtec would dispose of dredge spoils in an existing State of New Jersey dredge spoils basin on New Jersey Department of Transportation (NJDOT) property east of the barge landing (an upland location).

Although Holtec anticipates completing most site restoration activities by mid-2025, Holtec will not complete final site restoration until after spent fuel is transferred to the DOE and the ISFSI is decommissioned and demolished. Holtec anticipates that these activities would occur by the end of 2035, at which time the Oyster Creek site would be fully restored. No in-water work, inclusive of barge transports, is anticipated to occur after June 2025.[7]

3.4 ACTION AREA

The action area is "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR 402.02). The action area includes the underwater areas affected by operations of OCNGS, including the south fork of the Forked River, Oyster Creek, and Barnegat Bay. The discharge plume during plant operation occupied Oyster Creek and extended 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 did not extend to the bottom of the Bay except in the area immediately adjacent to the mouth of Oyster Creek. Additionally, the action area includes the areas within the Forked River, Oyster Creek, and Barnegat Bay where dredging may occur and where barges may be used to transport materials removed from the project site. As we do not know where in the Atlantic Ocean a vessel will be operating once it leaves Barnegat Bay, any effects (or consequences) to listed species are not reasonably certain to occur. Thus, the action area for this consultation does not extend beyond Barnegat Bay. As such, 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 as well as the areas within those waterways where barge traffic and dredging will occur.

4.0 EFFECTS OF THE ACTION ON ATLANTIC STURGEON

The 2011 Biological Opinion was completed before the listing of the five DPSs of Atlantic sturgeon was effective. However, in the letter transmitting that Opinion to the NRC, we determined that conference was not necessary because we did not anticipate that Atlantic sturgeon would be present in the action area. At that time, there was no information to indicate that Atlantic sturgeon were present in the Forked River, Oyster Creek or Barnegat Bay. This remains the case as explained below.

The action area is within the marine range of all five DPSs of Atlantic sturgeon. However, there is no indication that Atlantic sturgeon occur in the action area. No Atlantic sturgeon have been impinged or entrained at OCGNS during its operational history and no Atlantic sturgeon have been collected during any fisheries sampling in these waterways. The State of New Jersey carried out studies to characterize fisheries in the Barnegat Bay watershed in 2012, 2013, and 2014 by sampling fish and blue crabs of varying age classes via trawling, nets, and traps at

[7] No information is available regarding transportation methods that may be selected by the Department of Energy for removal of spent fuel from the ISFSI (assumed to occur in 2034-2035).

stations both inside creeks and out in Barnegat Bay across seasons. This effort included sampling stations within the Bay and within Forked River and Oyster Creek. Despite using sampling gear that Atlantic sturgeon would be susceptible to capture in (otter trawl and gill net), no Atlantic sturgeon were captured (Able et al., 2012, 2013, and 2014). We are not aware of any reports of Atlantic sturgeon in the action area. Based on the best available information, we expect that the use of the action area by Atlantic sturgeon would be limited to rare, transient individuals in Barnegat Bay. We do not anticipate that any Atlantic sturgeon would occur in the Forked River or Oyster Creek. Given this information, it is extremely unlikely that any Atlantic sturgeon will be exposed to any stressors associated with the proposed action. Therefore, the proposed action is not likely to adversely affect any DPS of Atlantic sturgeon. Atlantic sturgeon will not be considered further in this consultation.

5.0 STATUS OF SEA TURTLE SPECIES

Four species of sea turtles listed under the ESA are seasonally present off the coast of New Jersey. Of these, three are present in the action area: Kemp's ridley *(Lepidochelys kempii),* North Atlantic DPS of green sea turtles *(Chelonia mydas)* and the Northwest Atlantic Ocean DPS of loggerhead sea turtles *(Caretta caretta).*

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.

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 do not occur in the action area for this consultation; therefore, leatherback sea turtles will not be exposed to any effects of the action. As such, this species will not be considered further in this Opinion.

Kemp's ridley sea turtles are currently listed under the ESA at the species level; green and loggerhead sea turtles are listed at the DPS level. Therefore, we included information on the range-wide status of Kemp's ridley sea turtles to provide the overall status of the species. Information on the status of loggerhead and green sea turtles is 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 U.S. FWS 1995, 2007a, 2007b, 2013; Hirth 1997; Marine Turtle Expert Working Group [TEWG] 1998, 2000, 2007, 2009; Conant et al.2009; Seminoff et al. 2015) and recovery plans for the loggerhead sea turtle (NMFS and U.S. FWS 2008; Bolten et al. 2019), Kemp's ridley sea turtle (NMFS et al.2011), green sea turtle (NMFS and U.S. FWS 1991). There is no designated critical habitat in the action area.

5.1 Green Sea Turtle (North Atlantic DPS)

The green sea turtle has a circumglobal distribution, occurring throughout tropical, subtropical and, to a lesser extent, temperate waters. They commonly inhabit nearshore and inshore waters. It is the largest of the hardshell marine turtles, growing to a weight of approximately 350 pounds (159 kilograms) and a straight carapace length of greater than 3.3 feet (one meter). The species was listed under the ESA on July 28, 1978 (43 FR 32800) as endangered for breeding populations in Florida and the Pacific coast of Mexico and threatened in all other areas throughout its range. On April 6, 2016, NMFS listed 11 DPSs of green sea turtles as threatened or endangered under the ESA (81 FR 20057). The North Atlantic DPS of green turtle is found in the North Atlantic Ocean and Gulf of Mexico (Figure 1) and is listed as threatened. Green turtles from the North Atlantic DPS range from the boundary of South and Central America (7.5°N, 77°W) in the south, throughout the Caribbean, the Gulf of Mexico, and the U.S. Atlantic coast to New Brunswick, Canada (48°N, 77°W) in the north. The range of the DPS then extends due east along latitudes 48°N and 19°N to the western coasts of Europe and Africa.

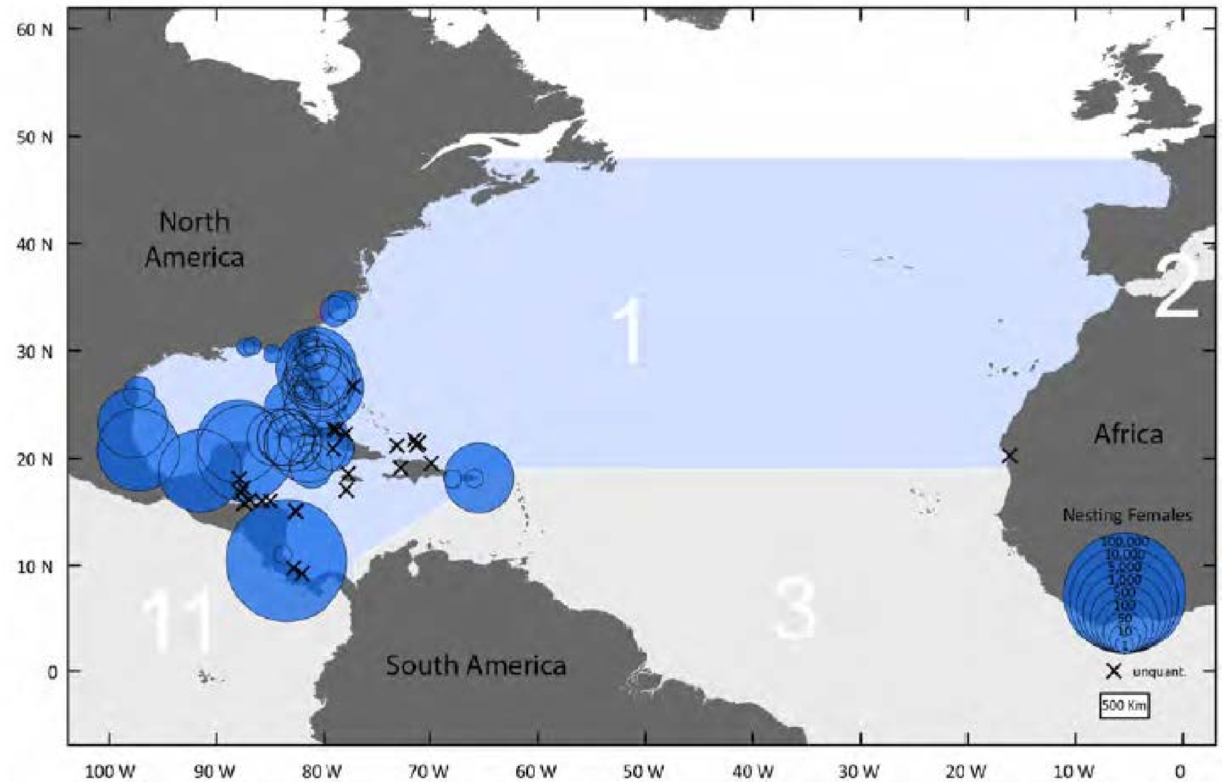

Figure 1: Geographic range of the North Atlantic distinct population segment green turtle (1), with location and abundance of nesting females. From Seminoff et al. (2015).

We used information available in the 2015 Status Review (Seminoff *et al.* 2015a), relevant literature, and recent nesting data from the Florida FWRI to summarize the life history, population dynamics and status of the species, as follows.

Life history

Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, Quintana Roo), United States (Florida) and Cuba (Figure 1) support nesting concentrations of particular interest in the North Atlantic DPS ((Seminoff *et al.* 2015b)). In the southeastern United States, females generally nest between May and September (Seminoff *et al.* 2015b, Witherington *et al.* 2006). Green sea turtles lay an average of three nests per season with an average of one hundred eggs per nest ((Hirth 1997, Seminoff *et al.* 2015b)). The remigration interval (period between nesting seasons) is two to five years ((Hirth 1997); (Seminoff *et al.* 2015b)). Nesting occurs primarily on beaches with intact dune structure, native vegetation, and appropriate incubation temperatures during the summer months.

Sea turtles are long-lived animals. Size and age at sexual maturity have been estimated using several methods, including mark-recapture, skeletochronology, and marked, known-aged individuals. Skeletochronology analyzes growth marks in bones to obtain growth rates and age at sexual maturity (ASM) estimates. Estimates vary widely among studies and populations, and methods continue to be developed and refined (Avens and Snover, 2013). Early mark-recapture studies in Florida estimated the age at sexual maturity 18-30 years (Mendonça 1981; Frazer and

Ehrhart, 1985, Ehrhardt and Witham 1992). More recent estimates of age at sexual maturity are as high as 35–50 years (Goshe 2010; Avens and Snover 2013), with lower ranges reported from known age turtles from the Cayman Islands (15–19 years; Bell et al., 2005) and Caribbean Mexico (12–20 years; Zurita et al., 2012). A study of green turtles that use waters of the southeastern United States as developmental habitat found the age at sexual maturity likely ranges from 30 to 44 years (Goshe et al. 2010). Green turtles in the Northwestern Atlantic mature at 85–100+ cm straight carapace lengths (SCL) (Avens and Snover, 2013).

Adult turtles exhibit site fidelity and migrate hundreds to thousands of kilometers from nesting beaches to foraging areas. Green sea turtles spend the majority of their lives in coastal foraging grounds, which include open coastlines and protected bays and lagoons. Adult green turtles feed primarily on seagrasses and algae, although they also eat other invertebrate prey ((Seminoff *et al.* 2015b).

Population dynamics

Compared to other DPSs, the North Atlantic DPS exhibits the highest nester abundance, with approximately 167,424 females at seventy-three nesting sites (using data through 2012), and available data indicated an increasing trend in nesting ((Seminoff *et al.* 2015b)). Counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size. Nesting occurs primarily in Costa Rica, Mexico, Florida, and Cuba. The largest nesting site in the North Atlantic DPS is in Tortuguero, Costa Rica, which hosts 79% of nesting females for the DPS (Seminoff *et al.* 2015a, Seminoff *et al.* 2015b).

The North Atlantic DPS has a globally unique haplotype, which was a factor in defining the discreteness of the DPS. Evidence from mitochondrial DNA studies indicates that there are at least four independent nesting subpopulations in Florida, Cuba, Mexico and Costa Rica ((Seminoff *et al.* 2015b)). More recent genetic analysis indicates that designating a new western Gulf of Mexico management unit might be appropriate (Shamblin *et al.* 2016).

There are no reliable estimates of population growth rate for the DPS as a whole, but estimates have been developed at a localized level. The status review for green sea turtles assessed population trends for seven nesting sites with more 10 years of data collection in the North Atlantic DPS. The results were variable with some sites showing no trend and others increasing. However, all major nesting populations (using data through 2011-2012) demonstrated increases in abundance ((Seminoff *et al.* 2015b)).

More recent data is available for the southeastern United States. The FWRI monitors sea turtle nesting through the Statewide Nesting Beach Survey and Index Nesting Beach Survey (INBS). Since 1979, the SNBS had surveyed approximately 215 beaches to collect information on the distribution, seasonality, and abundance of sea turtle nesting in Florida. Since 1989, the INBS has been conducted on a subset of SNBS beaches to monitor trends through consistent effort and specialized training of surveyors. The INBS data uses a standardized data-collection protocol to allow for comparisons between years and is presented for green, loggerhead, and leatherback sea turtles. The index counts represent 27 core index beaches. The index nest counts represent

approximately 67% of known green turtle nesting in Florida (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).

Nest counts at Florida's core index beaches have ranged from less than 300 to almost 41,000 in 2019. The nest numbers show a mostly biennial pattern of fluctuation (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/).

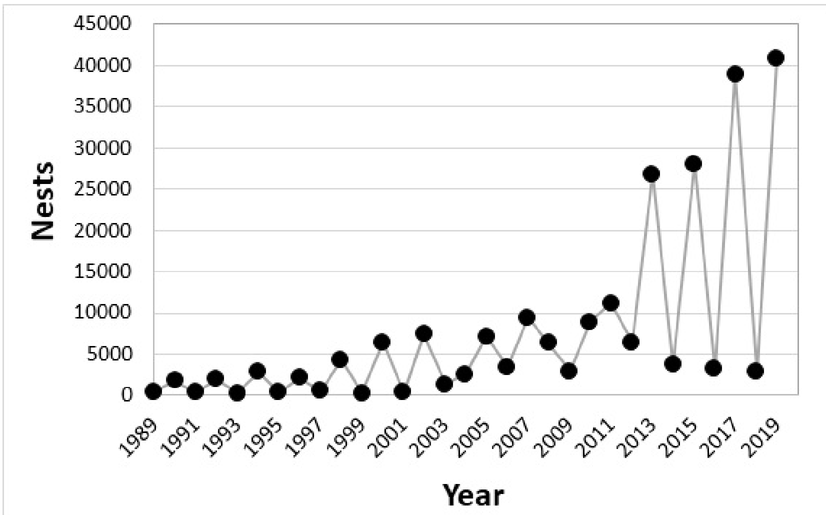

Figure 2: Number of green sea turtle nests counted on core index beaches in Florida from 1989-2019. Source: https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/.

Status

Historically, green sea turtles in the North Atlantic DPS were hunted for food, which was the principle cause of the population's decline. Apparent increases in nester abundance for the North Atlantic DPS in recent years are encouraging but must be viewed cautiously, as the datasets represent a fraction of a green sea turtle generation which is between 30 and 40 years ((Seminoff *et al.* 2015b)). While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue, the North Atlantic DPS appears to be somewhat resilient to future perturbations.

Recovery Goals

The recovery plan for green sea turtles has not been recently updated. In the plan, the recovery goal for the U.S. population of green sea turtles is delist the species once the recovery criteria are met (NMFS and U.S.FWS 1991). The recovery plan includes criteria for delisting related to nesting activity, nesting habitat protection, and reduction in mortality.

Priority actions to meet the recovery goals include:

1. Providing long-term protection to important nesting beaches.
2. Ensuring at least a 60% hatch rate success on major nesting beaches.
3. Implementing effective lighting ordinances/plans on nesting beaches.

4. Determining distribution and seasonal movements of all life stages in the marine environment.
5. Minimizing commercial fishing mortality.
6. Reducing threat to the population and foraging habitat from marine pollution.

5.2 Kemp's Ridley Sea Turtle

The range of Kemp's ridley sea turtles extends from the Gulf of Mexico to the Atlantic coast (Figure 3). They have occasionally been found in the Mediterranean Sea, which may be due to migration expansion or increased hatchling production (Tomas and Raga 2008). They are the smallest of all sea turtle species, with a nearly circular top shell and a pale yellowish bottom shell. The species was first listed under the Endangered Species Conservation Act (35 FR 18319, December 2, 1970) in 1970 and has been listed as endangered under the ESA since 1973.

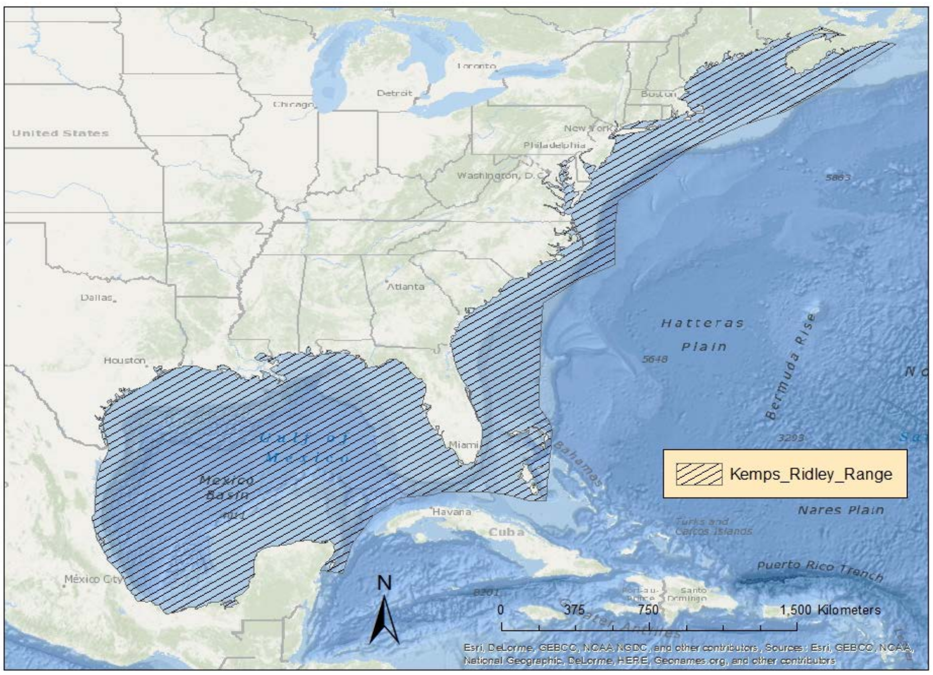

Figure 3: Range of the endangered Kemp's ridley sea turtle.

We used information available in the revised recovery plan (NMFS 2011), the Five-Year Review (NMFS 2015), and published literature to summarize the life history, population dynamics and status of the species, as follows.

Life History

Kemp's ridley nesting is essentially limited to the western Gulf of Mexico. Approximately 97% of the global population's nesting activity occurs on a 146-km stretch of beach that includes Rancho Nuevo in Mexico ((Wibbels and Bevan 2019)). In the United States, nesting occurs primarily in Texas and occasionally in Florida, Alabama, Georgia, South Carolina, and North Carolina (NMFS and U.S FWS 2015) Nesting occurs from April to July in large arribadas (synchronized large-scale nesting). The average remigration interval is two years, although intervals of 1 and 3 years are not uncommon (TEWG 1998, 2000, NMFS and U.S. FWS 2011).

Females lay an average of 2.5 clutches per season (NMFS and U.S. FWS 2011). The annual average clutch size is 95 to 112 eggs per nest ((NMFS 2015)). The nesting location may be particularly important because hatchlings can more easily migrate to foraging grounds in deeper oceanic waters, where they remain for approximately two years before returning to nearshore coastal habitats (Epperly et al. 2013; Snover et al. 2007; NMFS and U.S. FWS 2015). Modeling indicates that oceanic-stage Kemp's ridley turtles are likely distributed throughout the Gulf of Mexico into the northwestern Atlantic (Putnum et al. 2013). Kemp's ridley nearing the age when recruitment to nearshore waters occurs are more likely to be distributed in the northern Gulf of Mexico, eastern Gulf of Mexico, and the western Atlantic (Putnum et al. 2013).

Several studies, including those of captive turtles, recaptured turtles of known age, mark-recapture data, and skeletochronology, have estimated the average age at sexual maturity for Kemp's ridleys between 5 to 12 years (captive only, Bjorndal et al. 2014), 10 to 16 years (Chaloupka and Zug 1997; Schmid and Witzell 1997; Zug et al.1997; Schmid and Woodhead, 2000), 9.9 to 16.7 years (Snover et al.2007), 10 and 18 years (Shaver and Wibbels 2007), 6.8 to 21.8 years (mean 12.9 years) (Avens et al. 2017).

During spring and summer, juvenile Kemp's ridleys generally occur in the shallow coastal waters of the northern Gulf of Mexico from south Texas to north Florida and along the U.S. Atlantic coast from southern Florida to the Mid-Atlantic and New England. In addition, the NEFSC caught a juvenile Kemp's ridley during a recent research project in deep water south of Georges Bank (NEFSC, unpublished data). In the fall, most Kemp's ridleys migrate to deeper or more southern, warmer waters and remain there through the winter (Schmid 1998). As adults, many turtles remain in the Gulf of Mexico, with only occasional occurrence in the Atlantic Ocean (NMFS *et al.* 2010). Adult habitat largely consists of sandy and muddy areas in shallow, nearshore waters less than 120 feet (37 meters) deep (Seney and Landry 2008; Shaver et al. 2005; Shaver and Rubio 2008), although they can also be found in deeper offshore waters. As larger juveniles and adults, Kemp's ridleys forage on swimming crabs, fish, jellyfish, mollusks, and tunicates (NMFS 2011).

Population Dynamics

Of the sea turtles species in the world, the Kemp's ridley has declined to the lowest population level. Nesting aggregations at a single location (Rancho Nuevo, Mexico) were estimated at 40,000 females in 1947. By the mid-1980s, the population had declined to an estimated 300 nesting females. From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased at 15% annually (Heppell *et al.* 2005). However, due to recent declines in nest counts, decreased survival of immature and adult sea turtles, and updated population modeling, this rate is not expected to continue and the overall trend is unclear (NMFS and U.S. FWS 2015; Caillouett et al. 2018). In 2019, there were 11,090 nests, a 37.61% decrease from 2018 and a 54.89% decrease from 2017, which had the highest number (24,587) of nests (Figure 4 ; unpublished data). The reason for this recent decline is uncertain.

Using the standard IUCN protocol for sea turtle assessments, the number of mature individuals was recently estimated at 22,341 ((Wibbels and Bevan 2019)). The calculation took into account the average annual nests from 2016-2018 (21,156), a clutch frequency of 2.5 per year, a

remigration interval of 2 years, and a sex ratio of 3.17 females:1 male. Based on the data in their analysis, the assessment concluded the current population trend is unknown ((Wibbels and Bevan 2019)).

Genetic variability in Kemp's ridley turtles is considered to be high, as measured by nuclear DNA analyses (i.e., microsatellites) (NMFS 2011). If this holds true than rapid increases in population over one or two generations would likely prevent any negative consequences in the genetic variability of the species (NMFS and U.S. FWS 2011). Additional analysis of the mtDNA taken from samples of Kemp's ridley turtles at Padre Island, Texas, showed six distinct haplotypes, with one found at both Padre Island and Rancho Nuevo (Dutton *et al.* 2006).

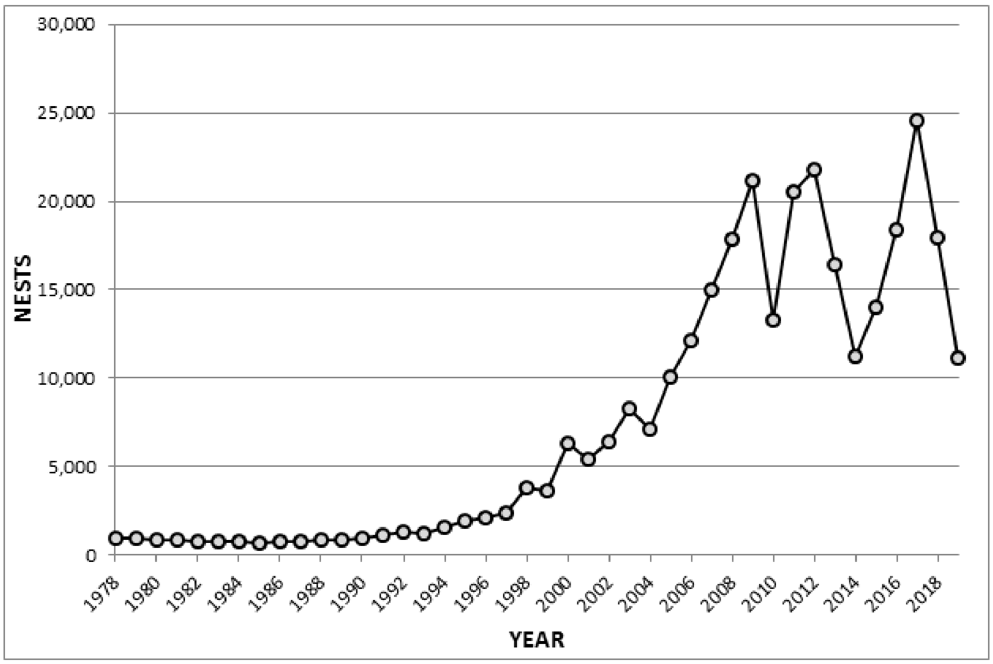

Figure 4: Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019).

Status

The Kemp's ridley was listed as endangered in response to a severe population decline, primarily the result of egg collection. In 1973, legal ordinances in Mexico prohibited the harvest of sea turtles from May to August, and in 1990, the harvest of all sea turtles was prohibited by presidential decree. In 2002, Rancho Nuevo was declared a Sanctuary. Nesting beaches in Texas have been re-established. Fishery interactions are the main threat to the species. Other threats include habitat destruction, oil spills, dredging, disease, cold stunning, and climate change. The current population trend is uncertain. While the population has increased, recent nesting numbers have been variable. In addition, the species' limited range and low global abundance make it vulnerable to new sources of mortality as well as demographic and environmental randomness, all of which are often difficult to predict with any certainty. Therefore, its resilience to future perturbation is low.

Recovery Goals

As with other recovery plans, the goal of the Kemp's ridley recovery plan is to conserve and protect the species so that the listing is no longer necessary. The recovery criteria relate to the number of nesting females, hatchling recruitment, habitat protection, social and/or economic initiatives compatible with conservation, reduction of predation, TED or other protective measures in trawl gear, and improved information available to ensure recovery. The recovery plan includes the complete downlisting/delisting criteria (NMFS and U.S. FWS 2015).

Priority actions to meet the recovery goals include:

1. Protect and manage terrestrial and marine habitats and Kemp's ridley populations.
2. Maintain the STSSN.
3. Manage captive stocks.
4. Develop local, state, national government, and community partnerships.
5. Educate the public.
6. Maintain and expand legal protections, promote awareness of these, and increase enforcement.
7. Implement international agreements.

5.3 Loggerhead Sea Turtle (Northwest Atlantic Ocean DPS)

Loggerhead sea turtles are circumglobal and are found in the temperate and tropical regions of the Indian, Pacific, and Atlantic Oceans. The loggerhead sea turtle is distinguished from other turtles by its reddish-brown carapace, large head and powerful jaws. The species was first listed as threatened under the Endangered Species Act in 1978 (43 FR 32800, July 28, 1978). On September 22, 2011, the NMFS and U.S. FWS designated nine distinct population segments of loggerhead sea turtles, with the Northwest Atlantic Ocean DPS listed as threatened (76 FR 58868). The Northwest Atlantic Ocean DPS of loggerheads is found along eastern North America, Central America, and northern South America (Figure 5).

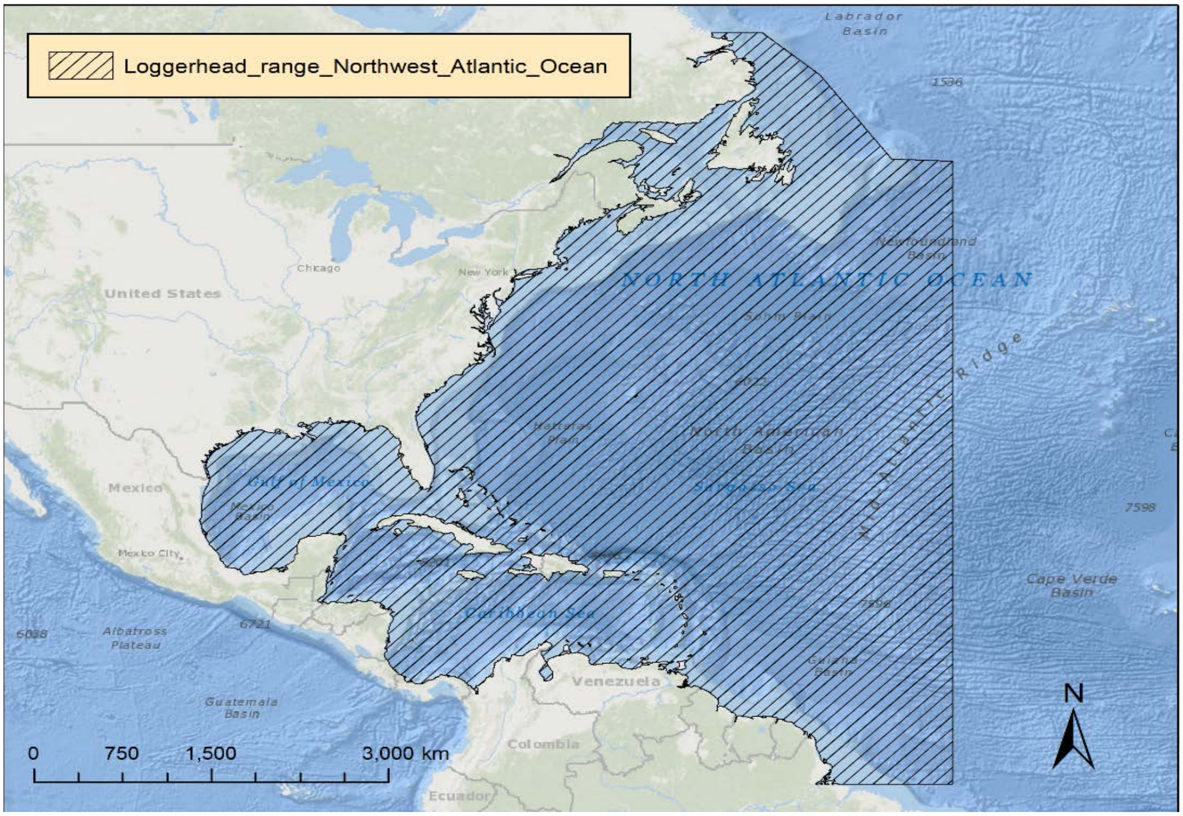

Figure 5: Range of the Northwest Atlantic Ocean DPS of loggerhead sea turtles.

We used information available in the 2009 Status Review (Conant *et al.* 2009), the final listing rule (76 FR 58868, September 22, 2011), the relevant literature, and recent nesting data from the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI)to summarize the life history, population dynamics and status of the species, as follows.

Life History

Nesting occurs on beaches where warm, humid sand temperatures incubate the eggs. Northwest Atlantic females lay an average of five clutches per year. The annual average clutch size is 115 eggs per nest. Females do not nest every year. The average remigration interval is three years (Conant *et al.* 2009). There is a 54% emergence success rate (Conant et al. 2009). As with other sea turtles, temperature determines the sex of the turtle during the middle of the incubation period. Turtles spend the post-hatchling stage in pelagic waters. The juvenile stage is spent first in the oceanic zone and later in coastal waters. Some juveniles may periodically move between the oceanic zone and coastal waters (Witzell 2002, Bolten 2003, Morreale and Standora 2005, McClellan and Read 2007, Mansfield 2006, Eckert *et al.* 2008, Conant et al. 2009). Coastal waters provide important foraging, inter-nesting, and migratory habitats for adult loggerheads. In both the oceanic zone and coastal waters, loggerheads are primarily carnivorous, although they do consume some plant matter as well (Conant et al. 2009). Loggerheads have been documented to feed on crustaceans, mollusks, jellyfish and salps, and algae (Bjorndal 1997; Seney and Musick 2007; Donaton et al. 2019).

Avens et al. (2015) used three approaches to estimate age at maturation. Mean age predictions associated with minimum and mean maturation straight carapace lengths were 22.5-25 and 36-38

years for females and 26-28 and 37-42 years for males. Male and female sea turtles have similar post-maturation longevity, ranging from 4 to 46 (mean 19) years (Avens et al. 2015).

Loggerhead hatchlings from the western Atlantic disperse widely, most likely using the Gulf Stream to drift throughout the Atlantic Ocean. MtDNA evidence demonstrates that juvenile loggerheads from southern Florida nesting beaches comprise the vast majority (71%-88%) of individuals found in foraging grounds throughout the western and eastern Atlantic: Nicaragua, Panama, Azores and Madeira, Canary Islands and Andalusia, Gulf of Mexico, and Brazil (Masuda 2010). LaCasalla et al. (2013) found that loggerheads, primarily juveniles, caught within the Northeast Distant (NED) waters of the North Atlantic mostly originated from nesting populations in the southeast United States and, in particular, Florida. They found that nearly all loggerheads caught in the NED came from the Northwest Atlantic DPS (mean = 99.2%), primarily from the large eastern Florida rookeries. There was little evidence of contributions from the South Atlantic, Northeast Atlantic, or Mediterranean DPSs ((LaCasella *et al.* 2013)).

More recently, Stewart et al. (2019) assessed sea turtles captured in fisheries in the Northwest Atlantic. The analysis included samples from 850 (including 24 turtles caught during fisheries research) turtles caught from 2000-2013 in coastal and oceanic habitats. The turtles were primarily captured in pelagic longline and bottom otter trawls. Other gears included bottom longline, hook and line, gillnet, dredge, and dip net. Turtles were identified from 19 distinct management units; the western Atlantic nesting populations were the main contributors with little representation from the Northeast Atlantic, Mediterranean, or South Atlantic DPSs ((Stewart *et al.* 2019)). There was a significant split in the distribution of small (≤63 cm SCL) and large (>63 cm SCL) loggerheads north and south of Cape Hatteras, North Carolina. North of Cape Hatteras, large turtles came mainly from southeast Florida (44%±15%) and the northern United States management units (33%±16%); small turtles came from central east Florida (64%±14%). South of Cape Hatteras, large turtles came mainly from central east Florida (52%±20%) and southeast Florida (41%±20%); small turtles came from southeast Florida (56%±25%). The authors concluded that bycatch in the western North Atlantic would affect the Northwest Atlantic DPS almost exclusively ((Stewart *et al.* 2019)).

Population Dynamics

A number of stock assessments and similar reviews (NMFS 2001; Heppell et al. 2003b; TEWG 1998, 2000, 2009; NMFS and U.S. FWS 2008e; Conant et al. 2009; NMFS 2009a; Richards et al. 2011) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size. As with other species, counts of nests and nesting females are commonly used as an index of abundance and population trends, even though there are doubts about the ability to estimate the overall population size. Adult nesting females often account for less than 1% of total population numbers (Bjorndal *et al.* 2005).

Based on genetic analysis of nesting subpopulations, the Northwest Atlantic Ocean DPS is divided into five recovery units: Northern, Peninsular Florida, Dry Tortugas, Northern Gulf of Mexico, and Greater Caribbean (Conant *et al.* 2009). A more recent analysis using expanded mtDNA sequences revealed that rookeries from the Gulf and Atlantic coasts of Florida are genetically distinct (Shamblin *et al.* 2014). The recent genetic analyses suggest that the

Northwest Atlantic Ocean DPS should be considered as ten management units: (1) South Carolina and Georgia, (2) central eastern Florida, (3) southeastern Florida, (4) Cay Sal, Bahamas, (5) Dry Tortugas, Florida, (6) southwestern Cuba, (7) Quintana Roo, Mexico, (8) southwestern Florida, (9) central western Florida, and (10) northwestern Florida (Shamblin *et al.* 2012).

The Northwest Atlantic Ocean's loggerhead nesting aggregation is considered the largest in the world (Casale and Tucker 2017). Using data from 2004-2008, the adult female population size of the DPS was estimated at 20,000 to 40,000 females (NMFS 2009). More recently, Ceriani and Meylan (2017) reported a 5-year average (2009-2013) of more than 83,717 nests per year in the southeast United States and Mexico (excluding Cancun (Quintana Roo, Mexico)). These estimates included sites without long-term (≥10 years) datasets. When they used data from 86 index sites (representing 63.4% of the estimated nests for the whole DPS with long-term datasets, they reported 53,043 nests per year. Trends at the different index nesting beaches ranged from negative to positive. In a trend analysis of the 86 index sites, the overall trend for the Northwest Atlantic DPS was positive (+2%) (Ceriani and Meylan 2017). Uncertainties in this analysis include, among others, using nesting females as proxies for overall population abundance and trends, demographic parameters, monitoring methodologies, and evaluation methods involving simple comparisons of early and later 5-year average annual nest counts. However, the authors concluded that the subpopulation is well monitored and the data evaluated represents 63.4 % of the total estimated annual nests of the subpopulation and, therefore, are representative of the overall trend (Ceriani and Meylan 2017).

About 80% of loggerhead nesting in the southeast United States occurs in six Florida counties (NMFS and U.S. FWS 2008). The Peninsula Florida Recovery Unit and the Northern Recovery Unit represent approximately 87% and 10%, respectively of all nesting effort in the Northwest Atlantic DPS (NMFS and U.S. FWS 2008; Ceriani and Meylan 2017). As described above, FWRI's INBS collects standardized nesting data. The index nest counts for loggerheads represent approximately 53% of known nesting in Florida. There have been three distinct intervals observed: increasing (1989-1998), decreasing (1998-2007), and increasing (2007-2019). At core index beaches in Florida, nesting totaled a minimum of 28,876 nests in 2007 and a maximum of 65,807 nests in 2016 (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). In 2019, more than 53,000 nests were documented. The nest counts in Figure 6 represent peninsular Florida and do not include an additional set of beaches in the Florida Panhandle and southwest coast that were added to the program in 1997 and more recent years. Nest counts at these Florida Panhandle index beaches have an upward trend since 2010.

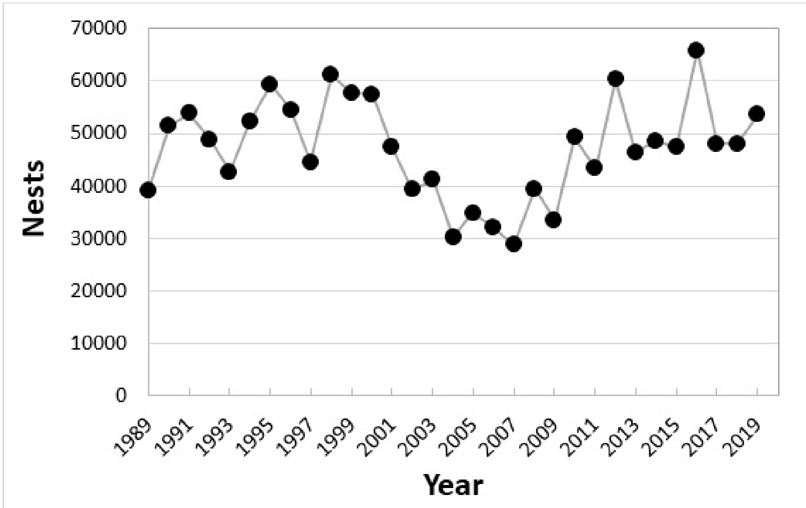

Figure 6: Annual nest counts for loggerhead sea turtles on Florida core index beaches in peninsular Florida, 1989-2019 Source: https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/.

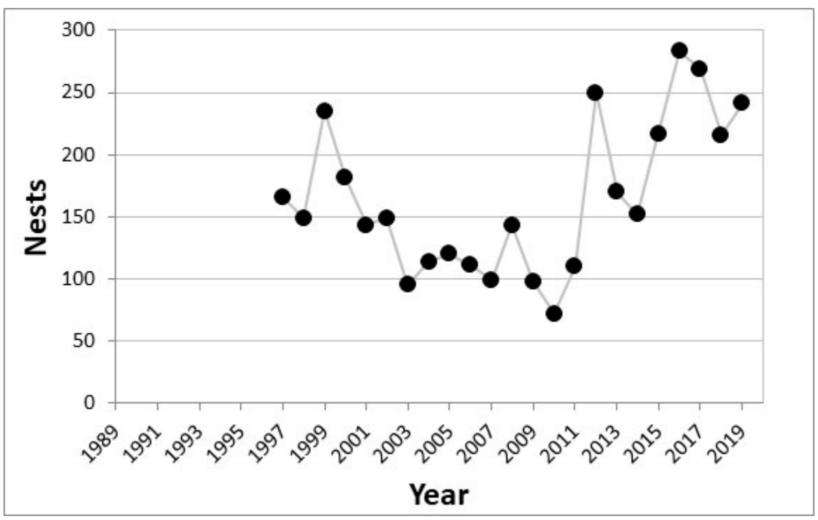

Figure 7: Annual nest counts on index beaches in the Florida Panhandle, 1997-2019. Source: https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/.

The annual nest counts on Florida's index beaches fluctuate widely, and we do not fully understand what drives these fluctuations. In assessing the population, Ceriani and Meylan (2017) and Bolten et al. (2019) looked at trends by recovery unit. Trends by recovery unit were variable.

The Peninsular Florida Recovery Unit extends from the Georgia-Florida border south and then north (excluding the islands west of Key West, Florida) through Pinellas County on the west coast of Florida. Annual nest counts from 1989 to 2018 ranged from a low of 28,876 in 2007 to

a high of 65,807 in 1998 (Bolten et al. 2019). More recently (2008-2018), counts have ranged from 33,532 in 2009 to 65,807 in 2016 (Bolten et al. 2019). Nest counts taken at index beaches in Peninsular Florida showed a significant decline in loggerhead nesting from 1989 to 2007, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington *et al.* 2009). Trend analyses have been completed for various periods. From 2009 through 2013, a 2% decrease for this recovery unit was reported (Ceriani and Meylan 2017). Using a longer time series from 1989-2018, there was no significant change in the number of annual nests (Bolten et al. 2019). It is important to recognize that an increase in the number of nests has been observed since 2007. The recovery team cautions that using short term trends in nesting abundance can be misleading and trends should be considered in the context of one generation (50 years for loggerheads) (Bolten et al. 2009).

The Northern Recovery Unit, ranging from the Florida-Georgia border through southern Virginia, is the second largest nesting aggregation in the DPS. Annual nest totals for this recovery unit from 1983 to 2019 have ranged from a low of 520 in 2004 to a high of 5,555 in 2019 (Bolten et al. 2019). More recently (2008-2019), counts have ranged from 1,289 nests in 2014 to 5,555 nests in 2019 (Bolten et al. 2019). Nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9% annually from 1983 to 2005 (NMFS and U.S. FWS 2007a). Recently, the trend has been increasing. Ceriani and Meylan (2017) reported a 35% increase for this recovery unit from 2009 through 2013. A longer-term trend analysis based on data from 1983 to 2019 indicates that the annual rate of increase is 1.3% (Bolten et al. 2019).

The Dry Tortugas Recovery Unit includes all islands west of Key West, Florida. A census on Key West from 1995 to 2004 (excluding 2002) estimated a mean of 246 nests per year, or about 60 nesting females (NMFS and U.S. FWS 2007a). No trend analysis is available because there was not an adequate time series to evaluate the Dry Tortugas recovery unit (Ceriani and Meyland 2017; Bolten et al. 2019), which accounts for less than 1% of the Northwest Atlantic DPS (Ceriani and Meyland 2017).

The Northern Gulf of Mexico Recovery Unit is defined as loggerheads originating from beaches in Franklin County on the northwest Gulf coast of Florida through Texas. From 1995 to 2007, there were an average of 906 nests per year on approximately 300 km of beach in Alabama and Florida, which equates to about 221 females nesting per year (NMFS and U.S. FWS 2008. Annual nest totals for this recovery unit from 1997-2018 have ranged from a low of 72 in 2010 to a high of 283 in 2016 (Bolten et al. 2019). Evaluation of long-term nesting trends for the Northern Gulf of Mexico Recovery Unit is difficult because of changed and expanded beach coverage. However, there are now over 20 years of Florida index nesting beach survey data. A number of trend analyses have been conducted. From 1995 to 2005, the recovery unit exhibited a significant declining trend (NMFS and U.S. FWS 2007a; Conant et al. 2009). Nest numbers have increased in recent years (Bolten et al. 2019; https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). In the 2009-2013 trend analysis by Ceriani and Meylan (2017), a 1% decrease for this recovery unit was reported, likely due to diminished nesting on beaches in Alabama, Mississippi, Louisiana, and Texas. A longer-term analysis from 1997-2018 found that there has been a non-significant increase of 1.7% (Bolten 2019).

The Greater Caribbean Recovery Unit encompasses nesting subpopulations in Mexico to French Guiana, the Bahamas, and the Lesser and Greater Antilles. The majority of nesting for this recovery unit occurs on the Yucatán Peninsula, in Quintana Roo, Mexico, with 903 to 2,331 nests annually (Zurita et al. 2003). Other significant nesting sites are found throughout the Caribbean, including Cuba, with approximately 250 to 300 nests annually (Ehrhart *et al.* 2003), and over 100 nests annually in Cay Sal in the Bahamas (NMFS and U.S. FWS 2008). In the trend analysis by Ceriani and Meylan (2017), a 53% increase for this Recovery Unit was reported from 2009 through 2013.

Status

Fisheries bycatch is the highest threat to the Northwest Atlantic DPS of loggerhead sea turtles (Conant et al. 2009). Other threats include boat strikes, marine debris, coastal development, habitat loss, contaminants, disease, and climate change. Nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. Overall, short-term trends have shown increases, however, over the long-term the DPS is considered stable.

Recovery Goals

The recovery goal for the Northwest Atlantic loggerhead is to ensure that each recovery unit meets its recovery criteria alleviating threats to the species so that protection under the ESA is not needed. The recovery criteria relate to the number of nests and nesting females, trends in abundance on the foraging grounds, and trends in neritic strandings relative to in-water abundance. The 2008 Final Recovery Plan for the Northwest Atlantic Population of Loggerheads includes the complete downlisting/delisting criteria (NMFS and U.S. FWS 2008). The recovery objectives to meet these goals include:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females.
2. Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes.
3. Manage sufficient nesting beach habitat to ensure successful nesting.
4. Manage sufficient feeding, migratory and internesting marine habitats to ensure successful growth and reproduction.
5. Eliminate legal harvest.
6. Implement scientifically based nest management plans.
7. Minimize nest predation.
8. Recognize and respond to mass/unusual mortality or disease events appropriately.
9. Develop and implement local, state, federal and international legislation to ensure long-term protection of loggerheads and their terrestrial and marine habitats.
10. Minimize bycatch in domestic and international commercial and artisanal fisheries.

11. Minimize trophic changes from fishery harvest and habitat alteration.
12. Minimize marine debris ingestion and entanglement.
13. Minimize vessel strike mortality.

6.0 ENVIRONMENTAL BASELINE

Environmental baseline refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, 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 which are contemporaneous with the consultation in process. The environmental baseline therefore, includes the past impacts of the operation of the Oyster Creek facility. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline; however, there are no such activities or facilities in the case of this consultation.

There are a number of existing activities that regularly occur in various portions of the action area, including operation of vessels and state authorized fisheries. There are also environmental conditions caused or exacerbated by human activities (i.e., water quality and noise) that may affect listed species in the action area. Some of these stressors may result in mortality or serious injury to individual animals (e.g., vessel strike, fisheries), whereas others result in more indirect or non-lethal impacts. For all of the listed species considered here, the status of the species in the action area is the same as the rangewide status presented in the Status of the Species section of this Opinion. Below, we describe the conditions of the action area, present a summary of the best available information on the use of the action area by listed species, and address the impacts to listed species of federal, state, and private activities in the action area.

As described above, the action area is limited to the Forked River, Oyster Creek, and portions of Barnegat Bay. Barnegat Bay is a shallow, lagoon-type estuary that is separated from the Atlantic Ocean by a nearly contiguous barrier island complex (Chizmadia et al. 1984; BBNEP 2001). The bay is approximately 43 mi long and 3 to 9 mi wide, with a depth of 3 to 23 feet; the greatest depths are associated with the Intracoastal Waterway, a dredged channel running parallel to the U.S. eastern seaboard (Chizmadia et al. 1984; BBNEP 2002). Freshwater enters the bay from numerous streams, including, from north to south, Manasquan River and Canal, Metedeconk River, Kettle Creek, Toms River, Cedar Creek, Stout Creek, Forked River, and Oyster Creek (Chizmadia et al. 1984). Seawater enters the bay from the north through the Point Pleasant Canal via Manasquan Inlet, and from the south through the Little Egg Inlet. There is also a connection between the Atlantic Ocean and Barnegat Bay through Barnegat Inlet, a narrow navigable passage through the barrier islands located to the east-southeast of Oyster Creek. Because of the limited connection of Barnegat Bay to the Atlantic Ocean, tides in the bay are attenuated relative to the open ocean (Chizmadia et al. 1984). Water salinity generally ranges from 11 to 32 parts per thousand (ppt); the highest salinity is associated with the inlets, and the

lowest is along the western shoreline near the mouths of various rivers and creeks. Water temperature in Barnegat Bay ranges from an average of 35ºF in winter to 75ºF in summer (Chizmadia et al. 1984; BBNEP 2001). Substrate in central portions of the bay is composed primarily of fine to medium sand, with muddier sand present closer to the western shore. The substrate in intertidal areas adjacent to the mouths of Forked River and Oyster Creek is primarily sandy mud (Chizmadia et al. 1984). The Final Comprehensive Conservation Management Plan (BBNEP 2002) identified the following concerns for Barnegat Bay and its watershed as "priority problems": Degraded water quality over extensive areas of the bay; Declines in fish and shellfish populations due to disease, reproductive failure, or mortality; Changes in abundance, diversity, and distribution of important estuarine organisms; Loss of submerged aquatic vegetation (SAV) (e.g., eelgrass [*Zostera marina*] beds), wetlands, and coastal salt marshes; Closure of shellfish beds due to chemical or microbial contamination; and, Outbreaks of human disease associated with swimming in contaminated waters or eating contaminated fish or shellfish. Federal, State, and local agencies have worked collaboratively to define and address the above issues since Barnegat Bay was included in the National Estuary Program.

6.1 Summary of Information on Listed Sea Turtles in the Action Area

Three ESA-listed species of sea turtles (North Atlantic DPS of green sea turtles, Northwest Atlantic Ocean DPS of loggerhead sea turtles, Kemp's ridley sea turtles) are seasonally present off the coast of New Jersey and occur at least occasionally in the action area between May and November each year.

The species of sea turtles considered here are highly migratory, with the smaller species of sea turtles typically occurring in areas of warmer water (≥15°C), as they are susceptible to cold stunning if water temperature is too low. Sea turtles most frequently occur in the action area during summer and fall months when water temperatures are the warmest. Sea turtles typically use these waters for foraging and resting (Spotila and Standora 1985).

Sea turtles in the action area are adults or juveniles; due to the distance from any nesting beaches, no hatchlings occur in the action area. Similarly, no reproductive behavior is known or suspected to occur in the action area. Sea turtles feed on a variety of both pelagic and benthic prey, and change diets through different life stages. Adult loggerhead and Kemp's ridley sea turtles are carnivores that feed on crustaceans, mollusks, and occasionally fish. Green sea turtles are herbivores and feed primarily on algae, seagrass, and seaweed. As juveniles, loggerhead and green sea turtles are omnivores (Wallace et al. 2009, Dodge et al. 2011, Eckert et al. 2012, *https://www.seeturtles.org/sea-turtle-diet*, Murray et al. 2013, Patel et al. 2016). The distribution of pelagic and benthic prey resources is primarily associated with dynamic oceanographic processes, which ultimately affect where sea turtles forage (Polovina et al. 2006). One of the main factors influencing sea turtle presence in mid-Atlantic waters is seasonal temperature patterns (Ruben and Morreale 1999). The distribution of sea turtles is limited geographically and temporally by water temperatures (Epperly *et al.* 1995a; Braun-McNeill *et al.* 2008b; Mansfield *et al.* 2009; James et al. 2006), with warmer waters in the late spring, summer, and early fall being the most suitable. Water temperatures too low or too high may affect feeding rates and physiological functioning (Milton and Lutz 2003); metabolic rates may be suppressed when a sea turtle is exposed for a prolonged period to temperatures below 8-10° C (Morreale *et al.* 1992; George 1997; Milton and Lutz 2003). That said, loggerhead sea turtles have been found in

waters as low as 7.1-8 ° C (review in Braun-McNeill *et al.* 2008; Smolowitz et al. 2015; Weeks *et al.* 2010). However, in assessing critical habitat for loggerhead sea turtles, the review team considered the water-temperature habitat range for loggerheads to be above 10° C (NMFS 2013). Sea turtles are most likely to occur in the action area when water temperatures are above this temperature, although depending on seasonal weather patterns and prey availability, they could be also present in months when water temperatures are cooler. All sea turtles have been collected at OCNGS between June and early November (no later than November 7). The number of sea turtles collected at OCNGS has been highly variable year to year. It is unknown if the collection trend is related to the number of sea turtles in the action area annually or related to other unknown factors. If the range of these sea turtle species shifts further north due to warming waters in the mid-Atlantic and Northeast, it is possible that the number of sea turtles in the action area could increase. It is also possible that as waters warm earlier in the spring and cool later in the fall that the time of year that sea turtles occupy the action area could increase. Any such change is expected to be gradual and incremental over time.

The only project within the action area that has been subject to formal section 7 consultation has been the operation of the OCNGS. The impact of the historical operation of the OCNGS on listed sea turtles is detailed below.

6.2 Impacts of Operation of the OCNGS

As noted above, the OCGNS was constructed in the 1960s and began generating power in 1969; power generation ceased with the shutdown of the facility in September 2018.

Impingement and Collection of Sea Turtles

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.

There have been 122 total observed sea turtles at the OCNGS intakes since 1992, including 88 Kemp's ridleys, 18 loggerheads (which includes 1 recapture), and 16 greens. These numbers include 33 dead sea turtles (28 Kemp's, 2 green, 3 loggerheads) that have been removed from the intakes at OCNGS since 1992.

Between 1992 and 2018, the number of sea turtles collected at the OCNGS intakes annually has ranged from zero (1995 and 1996) to a maximum of 12 in 2015. 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 4 (2015). The number of mortalities has been as high as four in 2009, while in most other years it has been one or zero. Nearly all of the turtles that were captured at Oyster Creek had some impairment prior to being rescued and transported to MMSC; the cause of observed injuries was not always determined

In the 2011 Opinion, we estimated, based on previous impingement rates, an amount of impingement for loggerhead, Kemp's ridley, and green sea turtles and estimated the number of impinged turtles that would be dead. In the ITS we exempted the following take: 71 Kemp's (26 dead); 6 loggerhead (1 dead); and 11 green (2 dead). Since that opinion was issued, 45 sea

turtles were collected at OCNGS. This included 31 Kemp's (8 dead), 7 loggerhead (1 dead), and 7 green (0 dead). As explained above, the ITS was exceeded when a 7th loggerhead was taken in July 2018. Monitoring of the intakes continued through November 2019; no sea turtles have been observed since commercial operations ceased in September 2018.

Of the 33 dead sea turtles, 10 (8 Kemp's ridley, 1 green, 1 loggerhead) were determined to have died prior to impingement. Of the remaining 23, 8 Kemp's ridleys and 1 green were confirmed (based on necropsy) to have died due to drowning. For the remaining 15 turtles, either no necropsy was conducted or it was and no cause of death could be determined. Based on this information, and conservatively assuming that any turtle where a cause of death could not be determined was related to OCNGS operation, 20 Kemp's ridley, 1 green, and 2 loggerheads were killed due to the operation of the OCNGS since 1992. In addition, the operation of the OCNGS may have contributed to the injury of other live sea turtles captured at the facility (89 total) and has disrupted the migratory movements of these turtles (due to the removal and transfer of individuals).

Since 1992, live sea turtles collected at OCNGS have been transferred to the Marine Mammal Stranding Center, a Sea Turtle Stranding Network partner. While removal from the water, taking measurements, holding the sea turtles and transferring live turtles to a rehabilitation facility causes stress and temporarily disrupts 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 two 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. We have no information to suggest that the handling and transfer of sea turtles to MMSC had 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 ensured 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 ensured that any sea turtles needing medical attention could be properly cared for. Two sea turtles removed from OCNGS were 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, the removal of sea turtles from the water at OCGNS and the transfer of these turtles to an appropriate stranding facility had a net beneficial effect to these turtles.

Effects on Sea Turtle Prey

The operation of the OCNGS intakes resulted in some 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. Studies reviewed by the NJ DEP (NJDEP draft NPDES permit 2005) estimate that the equivalent of 59,000 adult hard clams and 10,400 blue crabs are lost to impingement and entrainment each year. These organisms were no longer available for sea turtles to prey upon in the action area. In addition to clams and crabs, shrimp and fish were impinged and entrained at the facility each year. While the OCNGS caused the death of potential sea turtle forage items each year, there is

no evidence that sea turtles in the action area have been affected by a reduction in the availability of forage items. For example, sea turtles removed from the intake canal and structures 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 have decreased over time, when the numbers actually showed an increasing trend. Based on the best available information, while the operation of OCNGS reduced the amount of sea turtle forage items available for sea turtles in the action area, this loss was 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 treated wastewater effluents, collects and disposes of potential contaminants, and undertakes pollution prevention activities. A number of permits were in effect over the operational life of the project. Until a new permit became effective in April 2012, the facility operated pursuant to a permit last issued in 1994.

Impacts of chlorine used at the OCNGS
Low level, intermittent chlorination was used to control biofouling in the OCNGS service water system and circulating water systems. During operations, 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 did consume almost all remaining free chlorine and results in very little chlorine being released to the discharge canal (approximately 0.1 mg/l). The DWS did not have any chlorine discharges.

There is no information available on the effects of chlorination on sea turtles. It is also unknown as to whether any of the sea turtles collected 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[8] 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

8 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

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 has 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, the level of chlorination at the OCNGS has an insignificant effect on the ability for sea turtles to forage successfully in the action area.

Heated Effluent

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 resulted in heated discharge water mixing with the ambient water and elevating the normal water temperatures. Prior to plant shutdown, the NJPDES permit limited the discharge of heated effluent to an instantaneous maximum of 41.1°C (106°F) or 12.8°C (23°F) above ambient. The temperature rise of the CWS discharge was typically about 11ºC (19.8°F) above ambient canal temperatures, while the discharge canal temperature was approximately 5.6ºC (10.1°F) above ambient water temperatures when two dilution pumps were operating. During decommissioning, the heat rise during SFP cooling operation cause an increase of 2.5°F for 6,000 gpm of SW resulting in no or little immediate discharge canal temperature rise. The natural down stream flow of Oyster Creek flow at approximately 300,000 gpm limits the extent of the thermal plume.

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, as noted above, sea turtles have not been observed in the discharge channel.

In Barnegat Bay, temperatures are rapidly reduced by mixing with ambient temperature Bay water and through heat rejection into the atmosphere. In Barnegat Bay, during plant operation the plume occupied 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 did 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. The thermal plume is anticipated to be substantially smaller in area under post-shutdown operating conditions.

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.

There is no information to suggest that the thermal effluent discharged from the plant into Oyster Creek represented an attraction for turtles. If turtles were 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^{o}C), they could become cold stunned.

However, existing data from OCNGS and other power plants in the NMFS Greater Atlantic 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. There has been no evidence of any cold stunning of sea turtles in the action area and no evidence to indicate that operations of OCNGS contributed to any cold stunning outside the action area.

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 has 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.

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 were 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.

6.3 Consideration of Federal, State and Private Activities in the Action Area

Dredging of Barnegat Bay Channels
Occasional maintenance dredging (approximately every 5-10 years) occurs in the action area to maintain navigational channels at safe depths. These activities are authorized by the U.S. Army Corps of Engineers and the State of New Jersey. Dredging typically occurs with a cutterhead dredge with onshore disposal. No interactions with sea turtles have been recorded, which is consistent with our expectation that sea turtles are not vulnerable to impingement or entrainment with a cutterhead dredge. Dredging results in the removal of bottom sediments and as such results in a temporary disruption of benthic resources; however, the dredged areas are expected to be recolonized from nearby undredged areas resulting in only a temporary reduction in the availability of potential sea turtle prey. The effects of these occasional, temporary reductions in the amount of prey in the action area are likely to be so small that they cannot be meaningfully measured, evaluated, or detected.

Fishing Activity in the Action Area
Commercial and recreational fishing occurs in the action area. The action area is within New Jersey state waters. To date, New Jersey has not had a comprehensive program to capture data on bycatch or incidental capture of protected species such as sea turtles. We are not aware of any reports of the capture of sea turtles or Atlantic sturgeon in commercial or recreational fisheries in the action area. However, given that fisheries operate in the area that have the potential to interact with these species (e.g., hook and line, trawls, gillnets) we anticipate that there is at least occasional capture of individuals in the action area and that some percentage of these interactions would result in serious injury or mortality. 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. 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 given the use of fishing gear that is known to interact with sea turtles in areas and at times of year when sea turtles are present, at least occasional interactions are likely to occur.

Vessel Operations

The primary vessel traffic in the action area is recreational and fishing vessels. 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. Vessels larger than 65-feet are required to use the Automated Identification System (AIS). A review of AIS data for the action area indicates that, nearly all transits of vessels carrying AIS are in the deep-water channels and near Barnegat Inlet and that nearly all of the AIS carrying vessels are fishing or recreational vessels[9]. There is no recorded cargo or tanker vessel traffic in the action area. 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 five 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.

Other Factors

Sea turtles are exposed to a number of other stressors in the action area that are widespread and not unique to the action area which makes it difficult to determine to what extent these species may be affected by past, present, and future exposure within the action area. These stressors include water quality and marine debris. Marine debris in some form is present in nearly all parts of the world's oceans, including the action area. While the action area is not known to aggregate marine debris, marine debris, including plastics that can be ingested and cause health problems in sea turtles is expected to occur in the action area.

Over the last few decades, there has been growing concern about the health of Barnegat Bay based on observed loss of sea grasses such as eelgrass and widgeon grass, episodic blooms of macro algae and brown tides, decline of hard clams, and increasing numbers of invasive species such as sea nettles. The Barnegat Bay watershed monitoring conducted by NJDEP since 2011 is

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9 2017 "All Vessel Transit Counts" layer of the Mid-Atlantic Ocean Data Portal. *http://portal.midatlanticocean.org/visualize/#x=-74.19&y=39.79&z=12&logo=true&controls=true&dls%5B%5D=true&dls%5B%5D=0.5&dls%5B%5D=1339&basemap=Ocean&themes%5Bids%5D%5B%5D=8&tab=data&legends=false&layers=true.* Last accessed January 20, 2020.

a comprehensive program that provides data needed to make a thorough evaluation of the water quality condition within the bay and its tributaries. On December 21, 2010, the New Jersey Department of Environmental Protection (NJDEP) took initial steps toward developing water quality criteria through the adoption of narrative nutrient criteria for coastal waters (NJDEP, 2011). However, development of numeric translators for narrative nutrient criteria has not yet been completed.

NJDEP engaged multiple partners to carry out a comprehensive water-monitoring project. More than 10,000 water samples have been collected since June 2011 within the Barnegat Bay watershed. The study was designed to determine the locations and extent of water quality impairments and to calibrate and validate modeling tools that define the relationship between pollutant loads and water quality. This information will then be used, in combination with the findings of ecological research, to determine water quality thresholds, which are key to supporting the health of the various plant and animal communities that are the basis of a healthy ecology. The northern portion of the watershed contributes a significant amount to nutrient loading into the bay. There is variability of water quality within the bay, spatially and temporally. Assessing the water quality condition with both existing water quality criteria and targets used by other estuarine programs indicates that in some areas of the bay, the current water quality condition cannot fully support the designated use and ecological health of the bay. These water quality conditions may mean that the action area is less attractive to sea turtles if it cannot support abundant and diverse forage as well as other nearby areas.

7. EFFECTS OF THE ACTION

Here we consider the future effects associated with the OCNGS. The facility ceased commercial operations in September 2018. As such, the only remaining effects are those associated with shut down and decommissioning. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. We have determined that the effects of the action are the consequences of water withdrawal and associated discharge (occurring through June 2023), a potential, one-time dredge event (between 2020 and 2025), and the potential eight to 100 barge trips planned to remove components from the site (occurring through June 2025). All other activities will occur on land with no identified pathways of effects that could result in exposure of any listed species to effects of those land-based activities. All activities associated with the shutdown and decommissioning of the facility are anticipated to be complete by the end of 2035.

7.1 Water Withdrawal

When the facility was operational with all pumps operating, a total of approximately 1million gpm were withdrawn by the CWS and dilution water system (DWS), with approximately 460,000 gpm withdrawn through the CWS. For post-shutdown operations, after terminating use of the CWS, Exelon estimated that up to 12,000 gpm of water from the Forked River would continue to be withdrawn through the Circulating Water System (CWS) intake at an intake velocity of 0.02 fps through June 2023 for purposes of providing cooling water to the spent fuel

pool, Holtec reported that the withdrawal rate had declined to approximately 6,000 gpm by April 2019, further reducing the intake velocity.

NRC concluded that impingement of sea turtles is extremely unlikely to occur during the decommissioning period; we agree with this conclusion based on the rationale presented below.

As noted above, loggerhead, Kemp's ridley, and green sea turtles were impinged at the CWS and DWS intakes when the facility was operational. Over the period 2012-2018, an average of 0.33 loggerheads, 2 Kemp's ridley, and 0.5 green sea turtles were impinged at the CWS intakes per year. Assuming that the rate of impingement is proportional to the amount of water that is withdrawn (i.e., that rate increases as more water is withdrawn), and given that the amount of water withdrawn during the decommissioning period at the CWS (through June 2023) is approximately 2.6% of the amount withdrawn when the facility was operational (12,000/460,000), we can assume that the rate of impingement during decommissioning is approximately 2.6% annually (i.e., 0.009 loggerheads, 0.052 Kemp's ridley, and 0.013 greens). By multiplying that annual rate by the number of years that water will be withdrawn (2020-2023, 4 years) we can calculate an expected amount of impingement. Using this method, we calculated: 0.036 loggerheads, 0.21 Kemp's ridley, and 0.052 green sea turtles. These very low numbers, close to zero, are likely overestimates because: we considered four years of water withdrawals when water will not be withdrawn after June 2023, which is the beginning of the time of year that sea turtles are present in the action area, and the intake velocity (0.02 feet per second) is significantly less (1-2%) than it was during the operational period (approximately 1 foot per second at the CWS and 2 fps when both the CWS and DWS were operational), which even further reduces the potential for impingement. Further, our calculations of annual take during the 2012-2018 period included turtles that were removed from the Forked River near the intakes before they became impinged on the trash racks which may inflate the estimate if these turtles would have swum away on their own had they not been removed from the water by plant personnel (note that this procedure was in compliance with the 2011 Opinion and was carried out to reduce the risk of injury or mortality should the turtle have become impinged). Given how close to zero the calculated numbers are, and how we expect even those very small numbers to be an overestimate of impingement rate, it is not reasonable to expect that any sea turtles will be impinged at the CWS intakes while water is being withdrawn to cool the spent fuel pool between now and June 2023, or for any other purposes during decommissioning.

7.2 Discharge of Water

Water will be discharged into the discharge canal while the spent fuel pool continues to hold fuel (i.e., until June 2023). The discharge water is from the heat exchange process and does not contact any radioactive materials or other potential contaminants. Holtec reports that as of April 2019, water is discharged at a rate of approximately 6,000 gpm and at a temperature 1.4°C (2.5°F) above ambient. This discharge rate is less than 0.6% of the effluent that was discharged while the facility was operational and is discharged at a fraction of the temperature (during operations, the NJPDES permit for this facility limited the discharge of heated effluent to an instantaneous maximum of 41.1°C (106°F) or 12.8°C (23°F) above ambient. The temperature rise of the CWS discharge was typically about 11°C (19.8°F) above ambient canal temperatures, while the combined CWS and DWS discharge was approximately 5.6°C (10.1°F) above ambient water temperatures when two dilution pumps were operating.)

Heated water discharged from the CWS and ambient temperature intake canal water mix in the discharge canal and return to Barnegat Bay via the discharge canal. This process results in heated discharge water mixing with the ambient water and elevating the normal water temperatures. Several studies were carried out on the impact of the thermal plume during operations (OCNGS 2000); as noted above, both the volume and temperature of water discharged during the initial decommissioning period (until June 2023) are significantly less than during operations and therefore, the size of the thermal plume will be significantly smaller as it will take less mixing and less time for mixing to cause the plume to dissipate to ambient conditions.

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. 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. During full operating conditions, the plume occupied 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) and in general, elevated temperatures did 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 expected to be primarily on the surface, sea turtles may be exposed to the plume as they are coming up for air. The area and thermal effect of the plume is substantially reduced due to the much lower flow rates and temperatures occurring during decommissioning.

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 (104°F) can result in stress for green sea turtles (Spotila et al. 1997). Sea turtle eggs exposed to temperatures above 38°C (100.4°F) typically fail to hatch (Bustard and Grehan 1967). As noted above, the discharge temperature is approximately 1.4°C (2.5°F) above ambient. In order for the discharge to result in water temperatures above the stressful limit for sea turtles, ambient temperatures would need to be at least 38.6°C (101.5°F). Given that the average high water temperature in the action area is about 24°C (75°F), it is extremely unlikely that conditions would be present that would result in the discharge of the heated effluent resulting in water temperatures that would be stressful to any sea turtles present in the area. Conversely, it is extremely unlikely that the discharge of this heated effluent will warm the area enough to represent an attraction for turtles. If turtles were 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 were 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; 46 to 50°F), they could become cold stunned. However, existing data from OCNGS does 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 November 7, with the minimum recorded temperature at time of capture of 11.8°C (53.2°F), suggesting that sea turtles leave the action area before cold-stunning could potentially occur. Further, given the small increase in temperature associated with the discharge and the small area occupied by the thermal plume, it is extremely unlikely that any sea turtle would be attracted to the discharge and then subject to cold stunning.

While heat shock effects to fish were recorded at OCNGS during plant operations, the small amount of water being discharged and small increase over ambient make it extremely unlikely that such an event would occur during decommissioning. 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

We have considered if the continued 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 an impact on the turtles as it would in the winter (when the turtles are not present in the OCNGS area). 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). Given that any effects during the decommissioning period would be even less, we expect 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 any effects on foraging will be so small that they cannot be meaningfully measured, detected, or evaluated.

7.3 Dredging

Holtec anticipates that, if barging is selected as a transportation method for some materials, dredging in Oyster Creek between the barge landing and Barnegat Bay may be required to provide enough depth for barge vessels to pass. Dredging may also be required in Barnegat Bay itself to allow passage of loaded barges between the mouth of Oyster Creek and Barnegat Inlet. Any dredging would require Holtec to obtain U.S. Army Corps of Engineers and appropriate New Jersey Department of Environmental Protection, Division of Land Use Regulation, permits. Holtec would dispose of dredge spoils in an existing State of New Jersey dredge spoils basin on NJDOT property east of the barge landing. NRC assumes that the dredging would occur before 2025 and would be a one-time event carried out with a cutterhead dredge.

During cutterhead dredging, the dredge head is buried in the sediment, which produces a suction flow field. The amount of suction is a function of the diameter of the dredge pipe and the linear flow rates inside the pipe (Clausner and Jones 2004). Large pipes and higher flow rates create greater suction velocities and a wider flow field. The suction produced decreases exponentially with distance from the dredge head (Boysen and Hoover 2009). Cutterhead dredge heads do not begin operating until they are placed within dredge site sediments. Sea turtles are not known to be vulnerable to impingement or entrainment in cutterhead dredges, presumably because they can easily avoid any suction associated with the cutterhead.

Dredging also may affect sea turtles by reducing the amount of benthic prey in the area where sediments are removed. Dredging results in the direct removal of benthic habitat along with infaunal and epifaunal organisms of limited mobility. Thus, dredging can be expected to cause short-term reductions in biomass of benthic organisms. Dredging also creates sediment plumes that increase water turbidity, which may affect aquatic biota and create short-term decreases in habitat quality during and after dredging. Turbidity primarily affects liquid-breathing organisms, such as fish and shellfish, as well as aquatic plants because turbid conditions typically decrease photosynthetic capabilities. Turbidity levels associated with the sediment plumes of cutterhead dredges typically range from 11.5 to 282.0 mg/L with decreasing concentrations at greater distance from the dredge head (Nightingale and Simenstad 2001). Studies of benthic community recovery following dredging indicate that species abundance and diversity can recover fully following dredging (Michel et al. 2013). Specifically, within temperate, shallow water regions containing a combination of sand, silt, or clay substrate, such as the conditions present in the Oyster Creek action area, benthic communities can recover in one to eleven months, according to studies reviewed by Wilbur and Clarke (2007). Sea turtles prey on a variety of pelagic, epibenthic, and benthic organisms, some of which could be affected by dredging. Kemp's ridley and loggerhead sea turtles are primarily carnivorous. Kemp's ridley turtles eat sea urchins, squid, and jellyfish, as well as certain benthic shellfish. Loggerheads eat sea urchins, horseshoe crabs, clams, mussels, and other benthic invertebrates. Juvenile green sea turtles are omnivorous and eat insects, crustaceans, seagrasses, algae, and worms, while adult green turtles are herbivores and restrict their diets to seagrasses and algae. The areas that would be affected by dredging are freshwater or estuarine and, therefore, do not provide habitat for many preferred sea turtle prey and forage (e.g., sea urchins, squid, jellyfish, and seagrasses). Pelagic prey species would also be largely unaffected because dredging primarily disrupts the lower portion of the water column and substrates. Adult green turtles would not be expected to forage in the action area due to lack of preferred vegetation. Freshwater and estuarine mollusks and crustaceans, which are prey of Kemp's ridley turtles, loggerheads, and juvenile green turtles, are present in the area that would be affected by dredging. Smaller mollusks and crustaceans may be susceptible to entrainment into the dredge head. Larger individuals or those that are farther from the dredge head could move away from the suction flow field to avoid being entrained. All prey in the dredge area could also be affected by other factors, such as sedimentation and turbidity. However, as explained above, the local benthic community would likely recover within one year or less such that any local reductions in benthic biomass or other observable impacts would be relatively short term. These reductions would also be limited to the areas being dredged, which are only a small portion of the action area and an even smaller portion of Barnegat Bay. Based on the above analysis all effects associated with cutterhead dredging on foraging sea turtles

would be too small to be meaningfully measured or detected and would, therefore, be insignificant.

7.4 Vessel Traffic
During the decommissioning period, Holtec anticipates that it may elect to ship dismantled large plant components and other wastes by barge from an existing barge landing at the north bank of Oyster Creek immediately east of U.S. Highway 9. The previous licensee has periodically used this barge landing during both the construction and operation periods to transport large components to and from the site. The barge landing contains no permanently installed equipment or infrastructure, and Holtec anticipates that none would be needed to support barge traffic and loading associated with decommissioning. Barge vessel traffic would only occur during the large component removal phase of the decommissioning period. NRC currently anticipates that this phase would occur between 2020 and 2025, with between 8 and 100 barge trips may be required.

Bulk material delivery scow barges typically have a draft of 11 feet maximum and a speed of 1 to 7 knots. The increase in vessel traffic in the action area is 2 to 25 vessel trips per year over a no more than five-year period. This is an extremely small increase in vessel traffic in the action area; a review of publicly available AIS data for 2017 indicates that the channels in the action area had between 250 to over 1,500 individual vessel tracks that year. In addition to vessels carrying AIS (required only for vessels with an overall length greater than 65'), Barnegat Bay is used by hundreds to 1,000s of recreational vessels and smaller fishing vessels that do not carry AIS.

Factors thought to be relevant to increasing risk of vessel strike include high speeds, limited clearance with the bottom, and restricted or narrow waterways; these factors all seem to contribute to the reduced ability of a sea turtle to avoid an oncoming vessel. None of those factors is present in this situation. All of these barges are expected to move slowly (less than 7 knots). Slow operating speeds are expected to reduce the risk of vessel strike for sea turtles because they would allow for greater opportunity for individuals to avoid the vessel. There will be at least several feet of clearance between the barges and the bottom at the shallowest conditions, with more clearance in other conditions; given the swimming ability of sea turtles in the action area, a sea turtle should be able to swim under the vessel without being hit. The areas to be transited by the barges are free flowing with no obstructions; therefore, there is ample room for a sea turtle to avoid a vessel. Given the slow operating speeds of the vessels, the clearance between the vessels and the river bottom, and the un-impeded geography of the action area, we expect sea turtles to be able to avoid any vessels. These factors, combined with the relatively small number of vessel trips (8 to 100 over five years), make it extremely unlikely that a project vessel will strike a sea turtle. We have also considered whether avoiding these project vessels increases the risk of being struck by non-project vessels operating in the action area. In order for this to occur, another vessel would have to be close enough to the project vessel such that the animal's evasive movements made it such that it was less likely to avoid the nearby vessel. Given common navigational safety practices (i.e., not traveling too close to other vessels to minimize the risk of collisions), it is extremely unlikely that another vessel would be close enough such that a sea turtle avoiding a project vessel would not be able to avoid another non-project vessel or that the risk of being struck by another non-project vessel would otherwise

increase. Based on this analysis, the increase in risk of vessel strike in the action area due to the increased barge traffic is so small that it cannot be meaningfully measured, evaluated, or detected and it is extremely unlikely that a project barge will strike a sea turtle.

8. CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 C.F.R. §402.02). 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. It is important to note that the ESA definition of cumulative effects is not equivalent to the definition of "cumulative impacts" under the National Environmental Policy Act (NEPA). The NEPA definition is considerably more broad.

During this consultation, we searched for information on future state, tribal, local or private (non-Federal) actions reasonably certain to occur in the action area. We did not find any information about non-Federal actions other than what has already been described in the *Environmental Baseline*; the primary non-Federal activities that will continue to occur in the action area are recreational fisheries, fisheries authorized by states, use of the action area by private vessels, discharge of wastewater and associated pollutants, and coastal development authorized by state and local governments. Any coastal development that requires a Federal authorization, inclusive of a permit from the USACE, would require future section 7 consultation and not be considered a cumulative effect. We do not have any information to indicate that effects of these activities over the life of the proposed action will have different effects than those considered in the Status of the Species and Environmental Baseline sections of this Opinion, inclusive of how those activities may contribute to climate change.

9.0 INTEGRATION AND SYNTHESIS OF EFFECTS

As explained in the Environmental Baseline, during the period when OCGNS was operational (1969-2018), 122 sea turtles were collected by plant personnel including 88 Kemp's ridleys, 18 loggerheads (which includes 1 recapture), and 16 greens. These numbers include 33 dead sea turtles (28 Kemp's, 2 green, 3 loggerheads) that have been removed from the intake canal and structures at OCNGS since 1992. Some of these sea turtles were impinged at the trash racks while others were proactively removed from the water. Live sea turtles were transported to MMSC where they were held in captivity for hours to months, treated for disease or injury, and eventually released back into the wild. While this holding and treatment disrupted the behaviors of these turtles it is expected to have had an overall beneficial effect by increasing the likelihood that the turtle would survive in the wild. No sea turtles were collected or observed in 2019 and no additional collection or impingement is expected to occur during the decommissioning period. We do not have any information that effects due to water discharge, including heated effluent, any release of contaminants, or loss of prey were anything but insignificant as anticipated in our 2011 Biological Opinion. We have determined that no sea turtles are likely to be impinged over the period when water will continue to be withdrawn through the cooling water system (through June 2023) and have determined that all other effects during the decommissioning period are either extremely unlikely to occur or will be so small that they cannot be measured, evaluated, or detected.

The Sea Turtle Stranding and Salvage Network is a cooperative effort comprised of federal, state, and permitted private partners working to inform causes of morbidity and mortality in sea turtles by responding to and documenting sea turtles, found either dead or alive (but compromised), in a manner sufficient to inform conservation management and recovery. While NMFS coordinates the Network, it is the participating local organizations that respond to stranded turtles, collect scientific data, transport sick and injured turtles to rehabilitation facilities, and help educate the public about sea turtle conservation. As explained here, we do not anticipate the future activities considered in this Opinion to result in the incidental take of any ESA listed sea turtles. In the event that a dead or compromised sea turtle is observed in the action area, this event should be reported to the local stranding network partner (the MMSC), who will provide appropriate direction for a response.

In the discussion below, we consider whether the effects of the action as a whole (i.e., past and future effects) 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 relevant species or DPS of sea turtle. The purpose of this analysis is to determine whether the action, in the context established by the status of the species, environmental baseline, and cumulative effects, is likely to jeopardize the continued existence of the species.

Below, for the listed species that may be affected by the action, we summarize the status of the species and consider whether the action will result in reductions in reproduction, numbers or distribution of these species and then considers whether any reductions in reproduction, numbers or distribution resulting from the action would reduce appreciably the likelihood of both the survival and recovery of these species, as those terms are defined for purposes of the federal Endangered Species Act. 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."

9.1 Northwest Atlantic DPS of loggerhead sea turtles

Nesting trends for each of the loggerhead sea turtle recovery units in the Northwest Atlantic Ocean DPS are variable. A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf, corrected for unidentified turtles in proportion to the ratio of identified turtles, estimates about 801,000 loggerheads (NMFS-NEFSC 2011). More recent nesting data indicate that nesting in Georgia, South Carolina, and North Carolina is now on an upward trend. Recent data from Florida index nesting beaches, which comprise most of the nesting in the DPS, indicate a 19% increase in nesting from 1989 to 2018. Ceriani and Meylan (2017) report a positive trend for this DPS. The primary threat to sea turtles in the

Northwest Atlantic is fishery bycatch. Fisheries bycatch is the highest threat to the loggerhead sea turtles globally (Conant et al. 2009).

Over the operational period of the OCNGS, 18 loggerheads were collected, some proactively with nets and some after impingement on the trash bars. Of these turtles, three were dead (one in 1992, one in 1994, and one in 2013). No information is available on the condition of the turtles captured in 1992 or 1994 and no necropsy was completed. As we do not know the cause of death, we conservatively assume for the purposes of this analysis that the cause of death was attributable to plant operations. The turtle collected in 2013 was examined by the Marine Mammal Stranding Center and the cause of death was determined to be a vessel strike due to the state of decomposition at collection and the existence of a cut that penetrated the back of the neck to the spine. The 16 live turtles collected at the facility were either returned to the water or were transferred to MMSC where they were evaluated and treated for any minor injuries and eventually released back into the wild. All future effects of the decommissioning of the OCNGS on loggerhead sea turtles are expected to be insignificant.

The mortality of two loggerhead sea turtles (assumed but not confirmed to be caused by the OCNGS) reduced 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 action (assuming all other variables remained the same). We expect that the majority of loggerheads in the action area originated from the Northern Recovery Unit (NRU) or the Peninsular Florida Recovery Unit (PFRU) and assume for purposes of this analysis that these two loggerheads came from one of these two recovery units.

Annual nest totals for the PFRU averaged 64,513 nests from 1989-2007, representing approximately 15,735 females per year (NMFS and USFWS 2008). Nest counts taken at index beaches in Peninsular Florida showed a significant decline in loggerhead nesting from 1989 to 2007, most likely attributed to mortality of oceanic-stage loggerheads caused by fisheries bycatch (Witherington et al. 2009). In the trend analysis by Ceriani and Meylan (2017), a 2% decrease for this Recovery Unit was reported.

The Northern Recovery Unit, from the Florida-Georgia border through southern Virginia, is the second largest nesting aggregation in the DPS, with an average of 5,215 nests from 1989-2008, and approximately 1,272 nesting females (NMFS and U.S. FWS 2008). For the Northern recovery unit, nest counts at loggerhead nesting beaches in North Carolina, South Carolina, and Georgia declined at 1.9% annually from 1983 to 2005 (NMFS and U.S. FWS 2007a). In the trend analysis by Ceriani and Meylan (2017), a 35% increase for this Recovery Unit was reported. In 2019, record numbers of loggerhead nests have been reported in Georgia and the Carolinas (https://www.cbsnews.com/news/rare-sea-turtles-smash-nesting-records-in-parts-of-southeast-georgia-south-carolina-north-carolina/; July 14, 2019).

The loss of two loggerhead sea turtles from 1992-2019 represents an extremely small percentage of the number of sea turtles in the PFRU or NRU. Even if the total population of the PFRU was limited to 15,735 loggerheads (the number of nesting females), the loss of 2 individuals would represent approximately 0.012% of the population. If the total NRU population was limited to 1,272 sea turtles (the number of nesting females), the loss of 2 individuals would represent

approximately 0.16% of the population. Even just considering the number of adult nesting females this loss is extremely small and would be even smaller when considered for the total recovery unit and represents an even smaller percentage of the DPS as a whole.

The loss of such a small percentage of the individuals from any of these recovery units represents an even smaller percentage of the DPS as a whole. Considering the extremely small percentage of the populations that were killed, it is unlikely that these deaths had a detectable effect on the numbers and population trends of loggerheads in these recovery units or the number of loggerheads in the Northwest Atlantic DPS.

Any effects on reproduction are limited to the future reproductive output of these individuals. Even assuming that this loss was a reproductive female, given the number of nesting adults in each of these populations, it is unlikely that the expected loss of loggerheads would affect the success of nesting in any year. Additionally, this extremely small reduction in potential nesters is expected to result in a similarly small reduction in the number of eggs laid or hatchlings produced in future years and similarly, an extremely small effect on the strength of subsequent year classes with no detectable effect on the trend of any recovery unit or the DPS as a whole. 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. Additionally, given the small percentage of the species that was lost, there is not likely to be any loss of unique genetic haplotypes and no loss of genetic diversity.

Live turtles captured at the facility had their movements temporarily disrupted; however, the action did not in the past and will not in the future have any effect on the distribution of loggerhead sea turtles in the action area or throughout their range.

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 loggerheads 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 loggerheads was stable or increasing over the period considered here.

Based on the information provided above, the death of two loggerheads 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 recovery and eventual delisting). 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 2 loggerheads represents an extremely small percentage of the DPS as a whole; (2) the death of 2 loggerheads will not change the status or trends of any recovery unit or the DPS as a whole; (3) the loss of 2 loggerheads is not likely to have an effect on the levels of genetic heterogeneity in

the population; (4) the loss of 2 loggerheads is likely to have an extremely small effect on reproductive output that will be insignificant at the recovery unit or DPS level; (5) the action will have no effect on the distribution of loggerheads 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 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, we have determined that the proposed action will not appreciably reduce the likelihood that loggerhead sea turtles will survive in the wild. Here, we consider 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. Thus, we have considered whether the proposed action will affect the likelihood that the NWA DPS of loggerheads can rebuild to a point where listing is no longer appropriate. In 2008, NMFS and the USFWS issued a recovery plan for the Northwest Atlantic population of loggerheads (NMFS and USFWS 2008). The plan includes demographic recovery criteria as well as a list of tasks that must be accomplished. Demographic recovery criteria are included for each of the five recovery units. These criteria focus on sustained increases in the number of nests laid and the number of nesting females in each recovery unit, an increase in abundance on foraging grounds, and ensuring that trends in neritic strandings are not increasing at a rate greater than trends in in-water abundance. The recovery tasks focus on protecting habitats, minimizing and managing predation and disease, and minimizing anthropogenic mortalities.

Loggerheads have a stable trend; as explained above, the loss of two loggerheads over the life span of the proposed action will not affect the population trend. The number of loggerheads that died at OCNGS is an extremely small percentage of any recovery unit or the DPS as a whole. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the proposed action will not affect the likelihood that the demographic criteria will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; all effects to habitat will be insignificant; therefore, the proposed action will have no effect on the likelihood that habitat based recovery criteria will be achieved. The proposed action will also not affect the ability of any of the recovery tasks to be accomplished.

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 operation of the OCNGS resulted in a small reduction in the number of loggerheads and a small reduction in the amount of potential reproduction due to the loss of these individuals, these effects will be undetectable over the long-term and the actions considered here are not expected to have long term impacts on the future growth of the DPS or its potential for recovery. Therefore, based on the analysis presented above, the proposed action will not appreciably reduce the likelihood that the NWA DPS of loggerhead sea turtles can be brought to the point at which they are no longer listed as threatened.

Based on the analysis presented herein, the operation and decommissioning of the OCNGS is not likely to appreciably reduce the survival and recovery of the NWA DPS of loggerhead sea turtles.

9.2 North Atlantic DPS of green sea turtles

The North Atlantic DPS of green sea turtles is the largest of the 11 green turtle DPSs with an estimated abundance of over 167,000 adult females from 73 nesting sites. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015b). While the threats of pollution, habitat loss through coastal development, beachfront lighting, and fisheries bycatch continue for this DPS, they appear to be somewhat resilient to future perturbations. Over the operational period of the OCNGS, 16 green sea turtles were collected, some proactively with nets and some after impingement on the trash bars. Of these turtles, two were dead (one in 1999 and one in 2015). No information is available on the condition of the turtle captured in 1999 and no necropsy was completed. As we do not know the cause of death, we conservatively assume for the purposes of this analysis that the cause of death was attributable to plant operations. The turtle collected in 2015 was examined by the Marine Mammal Stranding Center and the cause of death was determined to be a vessel strike due to the state of decomposition at collection and the existence of a fractured carapace and severed vertebrae. The 14 live turtles collected at the facility either were returned to the water or were transferred to MMSC where they were evaluated and treated for any minor injuries and eventually released back into the wild. All other effects of the action on green sea turtles were and will be insignificant. All future effects of the decommissioning of the OCNGS on green sea turtles are expected to be insignificant.

The mortality of one green sea turtle (assumed but not confirmed to be caused by OCNGS operation), whether a male or female, immature or mature animal, reduced the number of green sea turtles as compared to the number of greens that would have been present in the absence of the operation of OCNGS. Assuming all other variables remained the same, the loss of one green sea turtle represents a very small percentage of the species as a whole. Even compared to the number of nesting females (167,000), which represent only a portion of the number of green sea turtles in the DPS, the mortality of one green represents less than 0.006% of the nesting population. The loss of this sea turtle 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, we consider the trend for green sea turtles to be stable. However, as explained below, the death of this green sea turtle 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. Live turtles captured at the facility had their movements temporarily disrupted; however, the action did not in the past and will not in the future have any effect on the

distribution of green sea turtles in the action area or throughout their range.

Based on the information provided above, the death of one green sea turtle over the operational period 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 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 1 green sea turtle represents an extremely small percentage of the species as a whole; (3) the loss of 1 green sea turtle will not change the status or trends of the species as a whole; (4) the loss of 1 green sea turtle is not likely to have an effect on the levels of genetic heterogeneity in the population; (5) the loss of 1 green sea turtle 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 green sea turtles to shelter and only an insignificant effect on individual foraging green sea turtles.

In rare 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, we have determined that the proposed action will not appreciably reduce the likelihood that green sea turtles will survive in the wild. Here, we consider 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. Thus, we have considered whether the proposed action will affect the likelihood that the species can rebuild to a point where listing is no longer appropriate. A Recovery Plan for Green sea turtles was published by NMFS and USFWS in 1991. The plan outlines the steps necessary for recovery and the criteria, which, once met, would ensure recovery. In order to be delisted, green sea turtles must experience sustained population growth, as measured in the number of nests laid per year, over time. Additionally, "priority one" recovery tasks must be achieved and nesting habitat must be protected (through public ownership of nesting beaches) and stage class mortality must be reduced. Here, we consider whether this proposed action will affect the population size and/or trend in a way that would affect the likelihood of recovery.

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. As explained above, the operation of the OCGNS is assumed to have resulted in the mortality of one green sea turtle (assumed but not confirmed to have been caused by OCNGS operation); however, as explained above, the loss of this individual over the time period that the facility was operational is not expected to affect the persistence of green sea turtles or the species trend. The actions considered here will not affect nesting habitat and will have only an extremely small effect on mortality. 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 operation of OCNGS resulted in a small reduction in the number of greens 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 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. We have considered the effects of the proposed action in light of cumulative effects explained above, and have 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 operation and decommissioning of the OCNGS is not likely to appreciably reduce the survival and recovery of this species.

9.3 Kemp's ridley sea turtles

Fishery interactions are the main threat to the species. Of the sea turtle species in the world, the Kemp's ridley has declined to the lowest population level. By the mid-1980s, the population had declined to an estimated 300 nesting females from 40,000 females in the 1940s. From 1980 to 2003, the number of nests at three primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) increased at 15% annually (Heppell *et al.* 2005). However, due to recent declines in nest counts, decreased survival of immature and adult sea turtles, and updated population modeling, this rate is not expected to continue and the overall trend is unclear (NMFS and U.S. FWS 2015; Caillouett et al. 2018). In 2019, there were 11,090 nests, a 37.61% decrease from 2018 and a 54.89% decrease from 2017, which had the highest number (24,587) of nests (Figure 4; unpublished data). The reason for this recent decline is uncertain. The number of mature individuals was recently estimated at 22,341 (Wibbels and Bevan 2019) with an unknown current trend. Over the operational life of the OCNGS, 88 Kemp's ridleys were collected or impinged and 28 were dead, with 20 of those deaths either known or conservatively assumed to be attributable to operations of the facility. All future effects of the decommissioning of the OCNGS are expected to be insignificant.

The mortality of 20 Kemp's ridleys between 1992 and 2018 reduced the number of Kemp's ridleys that would have been present absent the OCNGS. However, these mortalities represent a very small percentage of the population. Even taking into account just mature adults (22,341 in 2019), which are only a percentage of the total population, this loss represents approximately 0.09% of the population. Given this small percentage and the rate of loss (20 individuals over nearly 20 years), it is not likely that this reduction in numbers will change the status of this species or its trend. 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. Given the number of nesting adults, it is unlikely that the loss of these 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 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 was killed as a result of the operations of OCNGS, there was not likely 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 these 20 Kemp's ridley sea turtles between 1992 and 2018 has not appreciably reduced 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 actions considered here 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 death of these Kemp's ridleys during plant operation from 1992 to 2019 represents an extremely small percentage of the species as a whole; (3) the deaths 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 this individual 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 rare 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, we have determined that the proposed action will not appreciably reduce the likelihood that Kemp's ridley sea turtles will survive in the wild. Here, we consider 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. Thus, we have considered whether the proposed action will affect the likelihood that Kemp's ridleys can rebuild to a point where listing is no longer appropriate. In 2011, NMFS and the USFWS issued a recovery plan for Kemp's ridleys (NMFS et al. 2011); the plan includes a list of criteria necessary for recovery. These include:

1. An increase in the population size, specifically in relation to nesting females[10];
2. An increase in the recruitment of hatchlings[11];
3. An increase in the number of nests at the nesting beaches;
4. Preservation and maintenance of nesting beaches (i.e. Rancho Nuevo, Tepehuajes, and Playa Dos); and,
5. Maintenance of sufficient foraging, migratory, and inter-nesting habitat.

The number of Kemp's ridleys that died as a result of the operation of OCNGS is an extremely small percentage of the species. This loss will not affect the likelihood that the population will reach the size necessary for recovery or the rate at which recovery will occur. As such, the action considered here, will not affect the likelihood that criteria one, two or three will be achieved or the timeline on which they will be achieved. The action area does not include nesting beaches; therefore, the proposed action will have no effect on the likelihood that recovery criteria four will be met. All effects to habitat will be insignificant; therefore, the proposed action will have no effect on the likelihood that criteria five will be met.

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 actions will not change the rate at which recovery can occur. This is the case because while in the operation of the OCNGS result in the death of a small number of Kemp's ridleys and a small reduction in the amount of potential reproduction, these effects will be undetectable over the long-term and the actions are 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 Kemp's ridley 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 Kemp's ridley 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

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[10]A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos) is attained in order for downlisting to occur; an average of 40,000 nesting females per season over a 6-year period by 2024 for delisting to occur

[11] Recruitment of at least 300,000 hatchlings to the marine environment per season at the three primary nesting beaches in Mexico (Rancho Nuevo, Tepehuajes, and Playa Dos).

related to the proposed action. We have considered the effects of the proposed action in light of cumulative effects explained above, and have 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 operation and decommissioning of the OCNGS is not likely to appreciably reduce the survival and recovery of this species.

10.0 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, 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 Northwest Atlantic DPS of loggerhead sea turtles, Kemp's ridley sea turtles or the North Atlantic DPS or green sea turtles. No critical habitat is designated in the action area; therefore, none will be affected by the proposed action.

11. INCIDENTAL TAKE STATEMENT

An Incidental Take Statement exempts take for activities that have not yet occurred as of the date of the Biological Opinion. This Biological Opinion is a result of the reinitiation of a consultation that concluded with the issuance of an Opinion on November 21, 2011. The past take of green, Kemp's ridley, and loggerhead sea turtles was exempted by the ITS accompanying the previous Opinions. No additional take is anticipated or exempted. . As such, there is no Incidental Take Statement issued with this Opinion.

12. 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 Recommendation:

1. The NRC should use its authorities to support in-water assessments, abundance, and distribution surveys for sea turtles in the mid-Atlantic, including near shore habitats such as the action area. 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.

13. REINITIATION OF CONSULTATION

This concludes formal consultation on the operation, shutdown, and decommissioning of the OCNGS. 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.

14. LITERATURE CITED