UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

MAR 24 2016

Mr. James Danna
Environmental Review and Project Management Branch Chief
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Mail Stop O-11F1
Washington, DC 20555-0001

RE: Continued Operation of St. Lucie Nuclear Power Plant

Dear Mr. Danna:

Enclosed is the National Marine Fisheries Service's (NMFS) biological opinion on the effects of the continued operation of the St. Lucie Nuclear Power Plant Units 1 and 2 (SLNPP), as licensed by the U.S. Nuclear Regulatory Commission (NRC), on endangered and threatened species under NMFS's jurisdiction and critical habitat that has been designated for those species. We have prepared the biological opinion pursuant to section 7(a)(2) and the conservation review pursuant to section 7(a)(1) of the Endangered Species Act, as amended (ESA; 16 U.S.C. 1536(a)(2)).

After a non-lethal take of an endangered smalltooth sawfish in May 2005, NRC reinitiated formal consultation in February 2006, regarding continued operation of SLNPP. Furthermore, SLNPP exceeded its annual take limit of sea turtles in 2006, and NRC submitted a revised biological assessment in August 2007 to request formal inclusion of sea turtles in the reinitiated consultation. This biological opinion concludes the consultation that NRC reinitiated in 2006 for smalltooth sawfish and sea turtles.

Based on our assessment, we concluded that continued operation of SLNPP is not likely to jeopardize the continued existence of green sea turtle, hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, Northwest Atlantic distinct population segment of loggerhead sea turtle, or U.S. distinct population segment of smalltooth sawfish or to destroy or adversely modify the designated critical habitat of the loggerhead Northwest Atlantic distinct population segment.

This biological opinion concludes section 7 consultation on the continued operation of the St. Lucie Nuclear Power Plant, as licensed by the NRC. The NRC is required to reinitiate formal consultation on the proposed action, where it retains discretionary involvement or control over the action and if: (1) the amount of extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. Additionally, the NRC is required to reinitiate formal consultation with

NMFS regarding continued operation of SLNPP three years after the excluder devices are installed at the velocity caps.

If you have any questions regarding this biological opinion, please contact Cathy Tortorici at (301) 427-8495 or cathy.tortorici@noaa.gov.

Sincerely,

Donna S. Wieting
Director, Office of Protected Resources

NATIONAL MARINE FISHERIES SERVICE
ENDANGERED SPECIES ACT SECTION 7 BIOLOGICAL OPINION

Action Agencies: U.S. Nuclear Regulatory Commission

Activity Considered: Continued Operation of St. Lucie Nuclear Power Plant, Units 1 and 2 in St. Lucie County, Florida

Consultation Conducted By: Endangered Species Act Interagency Cooperation Division, Office of Protected Resources, National Marine Fisheries Service

Approved:

Donna S. Wieting
Director, Office of Protected Resources

Date: MAR 24 2016

Public Consultation Tracking System (PCTS) number: SER-2006-832

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1 INTRODUCTION

The Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.) establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7 (a)(2) of the ESA requires Federal agencies to consult with the United States Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), or both (the Services), to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7 (b)(3) of the ESA requires that at the conclusion of consultation, the Services provide an opinion stating how the agencies' actions will affect listed species and their critical habitat under their jurisdiction. If an incidental take is expected, section 7 (b)(4) requires the consulting agency to provide an incidental take statement that specifies the impact of any incidental taking and includes reasonable and prudent measures to minimize such impacts.

When a Federal agency's action "may affect" a listed species, that agency is required to consult formally with NMFS, the USFWS, or both, depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR §402.14(a)). Federal agencies are exempt from this general requirement if they have concluded that an action "may affect but is not likely to adversely affect" endangered species, threatened species, or designated critical habitat and NMFS or the USFWS concurs with that conclusion (50 CFR §402.14(b)).

For the action of continued operation of St. Lucie Nuclear Power Plant (SLNPP) Units 1 and 2, the action agency is the U.S. Nuclear Regulatory Commission (NRC). The NRC's licensee, Florida Power & Light Company (FPL), operates and maintains SLNPP and is considered to be the applicant for the purposes of this consultation.

The biological opinion and incidental take statement portions of this consultation were prepared in accordance with section 7 (b) of the ESA and implementing regulations at 50 CFR §402. This document represents NMFS's final opinion on the effects of the action on endangered and threatened species and critical habitat that has been designated for those species.

The document will be available through NMFS' Public Consultation Tracking System.

1.1 Background

NRC issued the first operating license for St. Lucie Unit 1 in 1976, but no ESA section 7 consultation was conducted. However, sea turtle takes occurred when operation began in 1977. In 1982, 1997, and 2001, NMFS issued biological opinions to NRC for the SLNPP.

In 1982, NRC and NMFS consulted, pursuant to ESA section 7, regarding the issuance of an operating license for St. Lucie Unit 2 (issued in 1983) based on the history of sea turtle takes at

Unit 1. The 1982 biological opinion documented that the operation of Unit 2 was not likely to jeopardize the continued existence of any listed species under NMFS jurisdiction, but the biological opinion lacked anticipated annual incidental take estimates.

Because of an increase in turtle takes, NRC reinitiated consultation in 1995, FPL implemented several mitigation measures, and NMFS issued a biological opinion in 1997. The 1997 biological opinion reached the conclusion that SLNPP operation was not likely to jeopardize the continued existence of any ESA-listed species under NMFS jurisdiction, and anticipated annual incidental take was identified for five sea turtle species: loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), and hawksbill (*Eretmochelys imbricata*).

In 1999, SLNPP exceeded the anticipated incidental take of green sea turtles per the 1997 biological opinion, and NRC reinitiated consultation in 2000. The most recent NMFS biological opinion was issued on May 4, 2001, regarding the effects of the continued operation of the SLNPP on endangered and threatened species, and NMFS concluded that the continued operation of the SLNPP was not likely to jeopardize the continued existence of endangered green, leatherback, hawksbill, and Kemp's ridley sea turtles and threatened loggerhead sea turtles. An incidental take statement was issued allotting take for each of these species, and the biological opinion was valid until May 4, 2011.

Finally, on June 3, 2002, NRC requested informal consultation for license renewal for SLNPP Units 1 and 2. On July 30, 2002, NMFS informed NRC that no consultation was necessary regarding the NRC's proposed action of renewal of the two operating licenses for SLNPP (both issued in 2003), and NMFS also corrected a mistake in the incidental take statement.

1.2 Consultation History

On May 16, 2005, a non-lethal take of a smalltooth sawfish (*Pristis pectinata*), which was listed in 2003 and, thus, not analyzed in the 2001 biological opinion, occurred at the SLNPP. NRC and NMFS had several discussions and met with FPL representatives for a site visit at SLNPP. On March 9, 2006, NMFS received NRC's biological assessment to reinitiate consultation to evaluate the effects to the endangered smalltooth sawfish, and NMFS responded that enough information was provided on April 24, 2006. On October 23, 2006, NMFS provided the draft terms and conditions to NRC and FPL for review and comment.

On October 25 and 26, 2006, a total of 21 loggerhead hatchling mortalities and 3 injuries occurred at the SLNPP intake screens after an undetected turtle nest was laid on an intake canal bank. As a result of those loggerhead takes and eight green turtle takes (one mortality and seven injuries) in 2006, the annual incidental take limit was exceeded, thus triggering reinitiation of consultation for sea turtles.

On November 1, 2006, NMFS, FPL, and NRC staff attended a sawfish safe handling and release training class at Mote Marine Laboratory. The NRC and FPL agreed to develop and coordinate a

sawfish safe handling and release plan and a transportation plan for the SLNPP. On November 30, 2006, NMFS sent the NRC and FPL a letter with the draft terms and conditions for smalltooth sawfish only.

On February 1, 2007, FPL notified NRC that SLNPP exceeded its annual take limit for sea turtles in 2006. On April 4, 2007, NRC notified NMFS that SLNPP exceeded its take limit for sea turtles in 2006 and requested inclusion of sea turtles in the ongoing consultation for smalltooth sawfish.

On April 18, 2007, NMFS met with the NRC and FPL at the SLNPP to discuss the information NMFS needed to complete a biological opinion for both the smalltooth sawfish and sea turtles. NMFS requested a transportation plan for smalltooth sawfish, information on dredging in the plant's intake canal, information on future construction plans or operations plans that may affect listed species, a plan for preventing future nesting along the cooling-water intake canal, and the design of a turtle excluder device for the intake pipes located in the Atlantic Ocean. During the site visit, NMFS and NRC observed as FPL conducted a video reconnaissance of the intake pipes, which revealed the existence of an abandoned pipe segment that trapped a green sea turtle during the scheduled outage of the plant. This turtle eventually traveled into the intake canal and was later released into the wild by FPL personnel. The parties also discussed the cleaning of the intake pipes planned for the fall of 2007.

On July 12, 2007, NMFS received the final transportation plan for the smalltooth sawfish from FPL. On August 16, 2007, NMFS received the biological assessment for sea turtles from the NRC. On September 12, 2007, NMFS requested additional information to complete the consultation for the SLNPP. NMFS requested information on dredging operations, bank restoration activities, and turtle excluder device design and installation timing. On September 26 and 27, 2007, NMFS received the information requested except for the turtle excluder design and installation information.

In November 2007, FPL attempted to clean all debris from the three intake pipes identified during the April 2007 video inspection. The dead end section of the southern 12-ft diameter intake pipe was capped and the debris was removed from this pipe. A portion of the internal debris was removed from the northern 12-ft diameter intake pipe by September 30, 2009. On December 20, 2007, NMFS participated in a conference call with the NRC and FPL to discuss the results of the intake pipe cleaning and future plant shutdown operating plans.

On January 14, 2009, FPL requested a change to the deadline for the design, testing, and implementation of the turtle excluder device for the intake pipes that are located in the Atlantic Ocean. NMFS agreed to extend the deadline to May 30, 2010, to provide FPL time to design, test, and implement the device.

On July 9, 2009, NMFS requested additional information on the number of non-causal takes of sea turtles (i.e., injuries or mortalities not attributed to plant operation), sea turtle rehabilitation processes, tangle net inspection schedules, and apparent discharges of sponge balls into the

ocean during condenser cleaning. The FPL provided responses to these requests on July 14 and 30, and on August 10, 2009.

On August 24, 2009, NMFS requested a copy of the sea turtle rehabilitation agreement between FPL and the Florida Fish and Wildlife Conservation Commission (FWC). On August 31, 2009, NMFS received an email response from FPL stating the rehabilitation agreement was an oral agreement between the SLNPP and FWC.

On September 28, 2009, FPL requested a meeting with NMFS to discuss NMFS's analysis of causal versus non-causal takes of sea turtles by the SLNPP. On November 12, 2009, staff from NMFS Southeast Regional Office's Protected Resources Division, NOAA's Office of General Counsel, FPL, and NRC participated in a conference call to discuss how NMFS would determine if species takes were considered non-causal or causal to the SLNPP operations.

On December 8, 2009, FPL requested a letter stating that NMFS would require a turtle excluder device on the intake pipe of the SLNPP. On December 9, 2009, NMFS emailed FPL that turtle excluder device requirement was being included in the draft biological opinion but that the biological opinion was not finalized yet.

On January 26, 2010, FPL emailed NMFS with information on the SLNPP's process and coordination efforts with FWC in determining the cause (non-causal or causal) of take of sea turtles entering the SLNPP. On January 28, 2010, FPL emailed NMFS a detailed summary status of captured sea turtles sent to rehabilitation facilities by the SLNPP.

On March 1, 2010, FPL requested a call with NMFS to discuss potential options for replacement of the 5-in mesh barrier net. On March 5, 2010, NMFS and FPL participated in a conference call to discuss the best design option for the 5-in mesh replacement barrier net (see section 2.1for detailed description).

On March 30, 2010, FPL provided NMFS with a plan to test the potential effectiveness of a sea turtle excluder device for the intake pipe. On April 1, 2010, NMFS Southeast Regional Office Protected Resources Division requested review of the "Testing Plan" by NMFS Southeast Fisheries Science Center's Harvesting and Engineering staff, and on April 2, 2010, NMFS emailed FPL comments and questions regarding the plan. On April 13 and 15, 2010, FPL provided NMFS with responses and a schedule for implementing the "Testing Plan" for the turtle excluder device. On April 13, 2010, NMFS emailed FPL stating that questions and comments had been addressed.

On May 20, 2010, FPL emailed NMFS the information requested indicating that the water box liners (i.e., coating) in the Taprogge system for condenser cleaning (see section 2.1for detailed description) had been replaced in an effort to reduce losses of sponge balls.

On May 21, 2010, the NRC emailed NMFS the information requested on the expiration dates of the SLNPP's license.

On June 29, 2010, NMFS staff requested additional information on the causal vs. non-causal effects from plant operations on turtles identified with shark bites on them. On July 22, 2010, FPL emailed NMFS information requested during NMFS internal review of the draft biological opinion on shark-bitten sea turtles that were captured in the intake canal at the SLNPP.

On January 6, 2011, the NRC contacted NMFS and stated that the NRC was developing an environmental assessment for the SLNPP for a 12% power uprate that was requested by FPL. On April 22, 2011, NMFS received a letter from the NRC with an effects determination for the 12% power uprate requested by FPL. The proposed extended power uprates would not increase the amount or flow rate of water withdrawal but would increase the temperature of discharged water by 3°F (1.7°C) above discharge temperature prior to the extended power uprate. As a result, the mixing zones at the end of the discharge pipelines would increase but would be within modified discharge permit limits. The NRC concluded that the higher temperatures would be within tolerance ranges of the smalltooth sawfish and sea turtles, and therefore, those ESA-listed species are unlikely to be adversely affected by the extended power uprates.

On May 16, 2011, NMFS requested an update on the status and timing of various ongoing activities (5-in mesh barrier net replacement, summary of sea turtle takes to date, and the "Testing Plan") to update the information in the draft biological opinion. On June 13 and July 18, 2011, NMFS received FPL responses on the updated information requested.

On September 26, 2011, NMFS requested additional information regarding sea turtle biologists' activities, intake canal dimensions, and turtle residency time in the canal (see section 2.1for detailed description). On October 7, 2011, FPL responded with the requested information.

On January 20, 2012, by letter to NRC, FPL formally requested a copy of the draft biological opinion for review once available from NMFS.

On January 23, 2012, NMFS requested of FPL historical water temperature data from 2005-2010, including ambient ocean water temperatures measured at the plant intake and maximum observed discharge temperatures. On January 25, 2012, FPL provided NMFS with the requested information.

On January 31, 2012, FPL provided NMFS with a copy of "Effects of Increased Water Temperature on the Marine Biota of the St. Lucie Plant Area," Applied Biology, Inc., July 1990.

On February 28, 2012, FPL provided NMFS with information regarding turtle nests in the vicinity of the SLNPP discharge and a copy of "Orientation and Swimming Behavior of Hatchling Loggerhead Turtles *Caretta caretta* during Their Offshore Migration," Salmon and Wyneken, 1987, to assist NMFS in calculating the number of hatchlings that could be affected by the discharge plume.

On May 1, 2012, NRC provided NMFS with a copy of the USFWS's biological opinion dated April 25, 2012, for potential effects of FPL's Discharge Headwall Project on nesting sea turtles.

On July 6, 2012, NRC published an Environmental Assessment and Finding of No Significant Impact (77 FR 40092) pursuant to the National Environmental Policy Act regarding proposed license amendments for extended power uprates at SLNPP that would increase the licensed megawatts from 2700 to 3020 for each unit. The NRC transmitted the document to NMFS by letter dated July 13, 2012.

On August 6, 2012, NMFS requested verification of the uprate level for the extended power uprate. On August 9, 2012, NRC confirmed requested information.

On September 17, 2012, FPL requested of NMFS an update on the status of the biological opinion. NMFS responded on the same day and stated that the biological opinion had been put on hold due to workload issues pending a September 26, 2012, internal NMFS meeting.

On September 27, 2012, NMFS informed NRC that a new NMFS staff member was being assigned to complete the biological opinion.

On December 11, 2012, NRC wrote NMFS and expressed concern with NMFS's delays in preparing a biological opinion for SLNPP. NRC and NMFS also discussed these concerns in a teleconference later that month.

On March 19, 2013, NMFS requested additional information regarding the turtle excluder device's design to exclude only 23 percent of captured turtles. On May 21, 2013, NRC responded asking clarifying questions regarding the mesh size of the turtle excluder device to better inform the engineers to get a proper response for NMFS's request.

On April 29, 2013, NMFS informed FPL and NRC that responsibility for writing the biological opinion would be passed to another NMFS staff member.

On July 23, 2014, NRC and NMFS staff visited the SLNPP site and met with FPL to discuss the information that NMFS needed to complete a biological opinion for smalltooth sawfish and sea turtles and also to review preliminary plans for the design of a turtle excluder device. On August 21, 2014, FPL provided NMFS and NRC preliminary drawings of the velocity cap with the turtle excluder device that NMFS had requested during the July 23rd visit.

On April 2, 2015, NMFS requested additional information from FPL because the timing and details of the testing plan for the excluder device had changed.

In June 2015, NMFS informed FPL and NRC that the consultation would be completed by NMFS Office of Protected Resources at the headquarters location in Silver Spring, Maryland.

On June 18, 2015, NMFS, FPL, and NRC discussed take limits and terms and conditions of the 2015 draft biological opinion.

On June 23 and 24, 2015, NMFS and FPL had discussions about a language concern regarding a specific term and condition. FPL requested a two-week delay and asked NMFS to stop work on the consultation until FPL could provide additional input. On June 24, 2015, NRC confirmed

that NMFS should put the consultation on hold until additional FPL comments are received and addressed.

On September 1, 2015, NMFS contacted NRC and FPL to check on the status of FPL's additional input and to determine whether NRC wanted to keep the consultation on hold.

On September 24, 2015, FPL requested deletion of the term and condition in question.

On January 14, 2016, NMFS transmitted a draft biological opinion to NRC for internal review.

On February 11, 2016, NRC and FPL transmitted comments to NMFS, and a conference call to discuss the comments was held on February 17, 2016. Per discussion on the call, NRC and FPL sent new information to NMFS on February 17-20, 2016.

This biological opinion is based on information provided during multiple site visits to SLNPP and in NRC's biological assessments dated February 2006 and August 2007, NMFS's previous biological opinion dated May 4, 2001, project-specific information from NRC and FPL, and NRC's 2012 Environmental Assessment for extended power uprates for SNLPP. The information in this biological opinion is from the 2001 biological opinion and the NRC's 2006 and 2007 biological assessments (NMFS 2001a; NRC 2006; NRC 2007) unless otherwise cited herein.

2 Description of the Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by federal agencies. *Interrelated* actions are those that are part of a larger action and depend on that action for their justification. *Interdependent* actions are those that do not have independent use, apart from the action under consideration.

2.1 Continued Operation of SLNPP

The NRC is the licensing and regulatory authority for all nuclear power plants in the United States. The proposed action for this consultation is FPL's continued operation of the SLNPP and the plant's circulating seawater cooling system, in accordance with their NRC licenses. The NRC licenses for the SLNPP require FPL to comply with the "Terms and Conditions" of the 2001 biological opinion; this biological opinion supercedes the 2001 biological opinion and applies to the remainder of the current license terms. The current license for Unit 1 of the plant will expire on March 1, 2036. Unit 2's license will expire on April 6, 2043. A description of SLNPP operations and activities follows, with particular emphasis on those aspects that may affect listed species.

The SLNPP has two operating nuclear reactors with circulating water systems that share features. The Atlantic Ocean provides cooling and receiving waters for both units' condensers and auxiliary cooling systems. Each cooling system is composed of intake and discharge components that are interdependent. The response of the affected components to changes or improvements will require evaluation to ensure the cooling system operation is kept within

design parameters and limits. The two nuclear reactors share common surface-level intake and discharge canals with buried ocean pipes (Figure 1).

2.1.1 Intake Systems

The major components of these canals and ocean pipes are: 1) three ocean intake structures and associated velocity caps located approximately 1,200 feet (356 m) from the shoreline; 2) three buried intake pipelines to transport water from the pipeline intake structure to the intake canal (one pipeline is 16 ft [4.9 m] in diameter, and two are 12 ft [3.65 m] in diameter); 3) common intake canal to convey sea water to each unit's intake structure; 4) Unit 1 and Unit 2 intake structures; 5) discharge structure for each unit; 6) a common discharge canal; 7) two discharge pipelines to convey water approximately 1,200 ft (365 m) offshore.

2.1.1.1 Intake Structures and Velocity Caps

The intake structures are located approximately 1,200 ft (365 m) offshore and about 2,400 ft (731 m) south of the discharge structures. The intake structures have a vertical section to minimize sand intake and a velocity cap to minimize fish entrapments, but no screens or grates are used to deny organisms access to the intake pipes. The tops of the intake structures are approximately 7 ft (2.1 m) below the surface at mean low water. Above the intake structures are velocity caps to reduce the vertical and horizontal flow rates into the pipelines. The square, 5-ft (1.5-m) thick velocity cap for the 16-ft (4.9-m) diameter pipe is 70 x 70 ft (6.5 x 6.5 m) and has a vertical opening of approximately 6.25 ft (1.9 m). The octagonal, 5-ft (1.5-m) thick velocity caps for the two 12-ft (3.65-m) diameter pipes are 52 x 52 ft (4.8 x 4.8 m) and have vertical openings of 6.5 ft (2.0 m).

The flow velocities at various locations of the velocity cap and intake structures have been calculated under various levels of biological fouling. The horizontal intake velocity range at the face of the ocean intake structure for the 12-ft (3.65-m) diameter pipes is calculated to be 0.37-0.41 ft/sec (11.2-12.6 cm/sec) and for the 16-ft (4.9-m) diameter pipe is calculated to be 0.92-1.0 ft/sec (28.3-30.5 cm/sec). As the water passes under the velocity cap, flow becomes vertical and the velocity increases to approximately 1.3 ft/sec (40.2 cm/sec) for the 12-ft (3.65-m) diameter pipes and 6.8 ft/sec (206 cm/sec) for the 16-ft (4.9-m) diameter pipe.

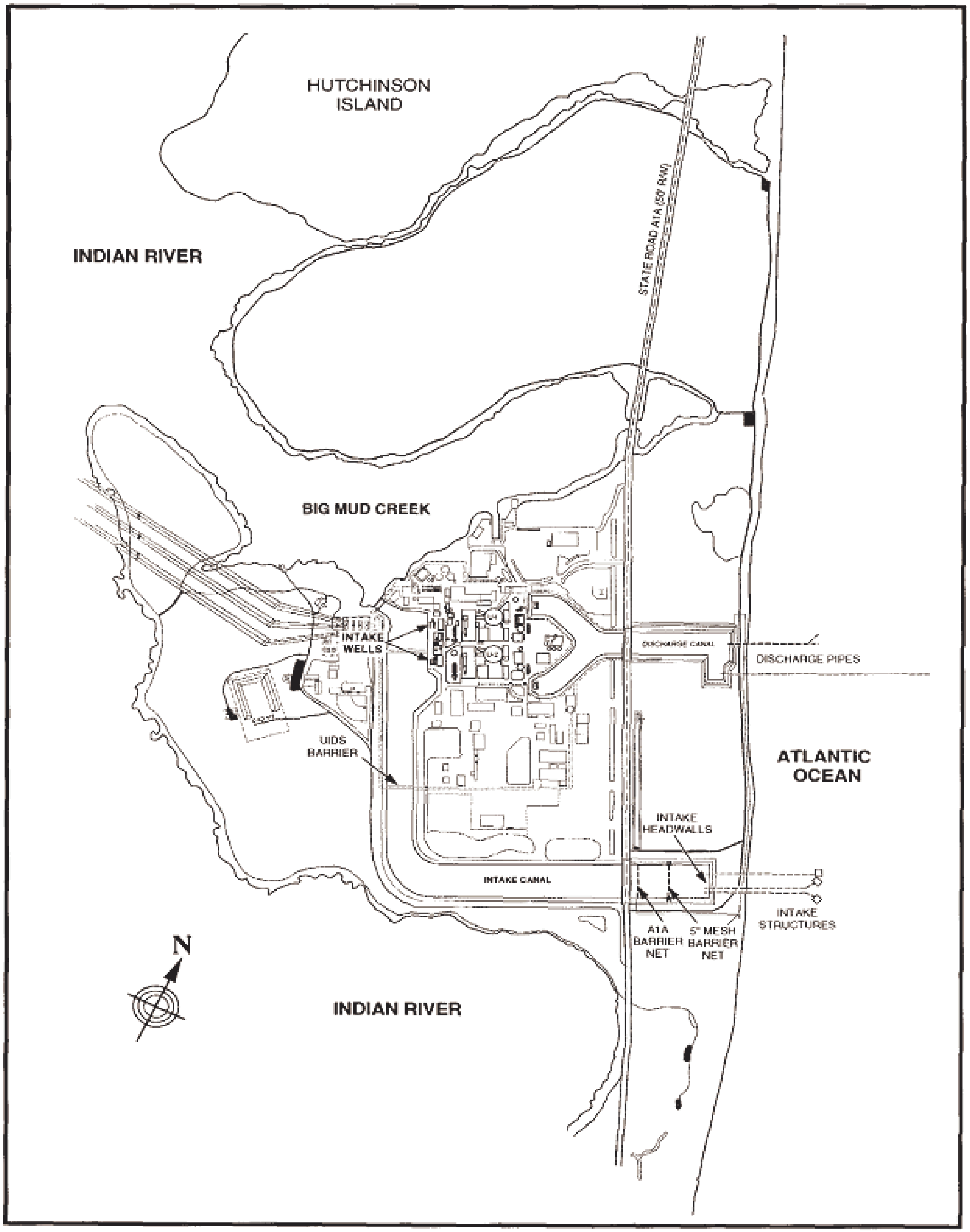


Figure 1. St. Lucie Nuclear Power Plant Circulating Water System.

Source: NRC 2006.

2.1.1.2 Intake Pipelines

From the ocean intake structure, water flows through the three buried pipelines for approximately 1,200 ft (365 m) and empties into the open intake canal behind the dune. The flow through these pipelines varies from 0.37-6.8 ft/s (0.11-2.1 m/s), depending on the pipeline and the degree of fouling. Transit time for an object to travel the distance through the pipeline is approximately 180-285 s (3-4.75 min).

Intake pipelines are periodically cleaned to remove debris and fouling organisms. Such cleaning maintains efficient flow and minimizes occurrence of scrapes or other minor injuries on organisms, such as sea turtles, that transit from the ocean to the intake canal via the pipeline.

2.1.1.3 Headwalls and Intake Canal

Approximately 450 ft (138 m) behind the primary dune line, the intake pipelines discharge water at two headwall structures into the intake canal. Due to erosion, the distance from the primary dune line is subject to change. The headwall structure for the two 12-ft (3.65-m) diameter pipes is a common vertical concrete wall. The headwall for the 16-ft-diameter pipe is more elaborate and consists of a guillotine gate in a concrete box open at the other end.

The 300-ft (91-m)-wide (at the top) intake canal is a trapezoidal channel with a maximum depth of approximately 25 ft (7.6 m). The flow rate in the canal is approximately 1 ft/sec (30.5 cm/sec). The canal’s L-shaped path carries the cooling water 5,000 ft (1,525 m) to the intake structures. The intake canal passes under a U.S. Highway A1A bridge permitted and inspected by the Florida Department of Transportation. The roadway is supported by a series of concrete pilings driven into the bottom of the intake canal.

Activities and barrier nets in the intake canal reduce impingement of organisms at the intake wells. The first permanent barrier net an organism would encounter has 5-in (12.7-cm) mesh and is taut and sloped to minimize entanglement. The 5-in net was replaced in January 2015, and the net was inspected and repaired after a turtle moved past it to the intake well on December 17, 2015. Sea turtle biologists monitor the net hourly from a boat during daylight hours and rescue any entangled turtles. Additionally, sea turtle biologists monitor the area between the headwalls and first barrier net daily. When visibility is good, the biologists capture sighted turtles by hand while free diving or with a dip net before the turtle encounters a tangle net, and biologists either return them to the wild or contact Florida Sea Turtle Stranding and Salvage Network (STSSN) for rehabilitation, as appropriate. All captured turtles are passive integrated transponder (PIT) tagged, and turtles without signs of flipper scarring or damage are also flipper tagged. When visibility is not ideal, the biologists deploy two tangle nets in daylight hours and inspect them at least hourly. The tangle nets have 18-in (40-cm) stretched mesh and are each about 100 ft (30.5 m) long; the unweighted, surface-floating nets are set adjacently in eddies and move with water flow. The second barrier net has 8-in (20-cm) mesh. The first two barrier nets are inspected underwater quarterly, and any holes are repaired at that time. The third and last barrier net has approximately 9-in (22.9-cm) mesh and is the Underwater Intrusion Detection System, which is

required for security reasons to prevent human intrusion into the owner-controlled area of the plant.

The FPL conducts periodic maintenance dredging in the intake canal with a suction dredge. Dredging is necessary to remove accumulated sediments and maintain proper flow conditions east of the 5-in (12.7-cm) mesh barrier net. Sediments collect in the canal from storm events and from normal plant operations. The suction dredge is fitted with a grate to limit the maximum opening size to 5-in to avoid the capture of listed species. The FPL isolates the dredge area, removes any sea turtles from the isolated area, continuously monitors the area, and uses a deflector on the dredge head to prevent sea turtles from coming in contact with the dredge head. Canal dredging is performed on an as-needed basis and is expected to occur every 8 to 10 years.

Hurricanes cause damage to canal banks in the intake canals. Restoration projects to restore the canal banks will occur periodically. The projects may involve the installation of an articulating concrete block revetment system. Associated dredging may be required using a non-hopper dredge, and excavators are placed on barges to grade the canal banks.

2.1.1.4 Intake Wells and Condensers

The intake wells are located at the entrance of the operating units. Water passes from the intake wells into the operating units to cool the plant. Each reactor unit has a separate cooling intake system consisting of four bays. Each bay contains trash racks that are vertical bars about 3-in (7.6-cm) apart to prevent large objects from entering the cooling system, traveling screens with a 3/8-in (1-cm) mesh to remove smaller debris and reduce impingement of organisms, and circulating water pumps. Approach velocities to each bay are calculated to be less than 1 ft/s (30.5 cm/s) but increase to approximately 5 ft/s (150 cm/s) at the trash racks. The trash racks are periodically cleaned by a rake that is lowered to the bottom of the rack with tines fitting between the bars. This rake is pulled vertically up and collects any debris that may have accumulated on the structures. This debris is emptied into a trough at the top of the intake bay for subsequent disposal. Any debris that is collected on the traveling screens is washed away by a series of spray jets and is then also emptied into a trough at the top of the intake bay for disposal. Additionally, security personnel inspect intake wells every six hours and report any sightings of threatened or endangered species.

After the water has passed through the trash racks, the traveling screens, and the circulating water pump, it travels through the condenser, which contains thousands of 3/8-in (1-cm) diameter tubes. Condenser water heat is transferred to the circulating water, which is then expelled into the discharge canal.

2.1.2 Discharge Systems

Each reactor unit discharges its condenser cooling water into the trapezoidal discharge canal that is approximately 240 ft (73 m) wide (at the top) and 2,200 ft (670 m) long. The canal terminates at two headwall structures approximately 450 ft (137 m) behind the primary dune line

approximately 2400 ft (730 m) north of the headwalls for the intake canal. Due to erosion, the distance from the primary dune line is subject to change. One structure supports a 12-ft (3.7-m) diameter pipeline that is buried under the ocean floor and runs approximately 1,500 ft (9460 m) offshore where it terminates into a two-port "Y" nozzle. The other structure supports a 16-ft (4.9-m) diameter pipeline that is buried under the ocean floor and runs approximately 3,375 ft (1,030 m) offshore. The last 1,400 ft (425 m) of this pipeline contain a multiport diffuser segment with 58 discharge ports. To minimize plume interference, the ports are oriented in an offshore direction on alternating sides of the pipeline.

In 2010, FPL ran a thermal plume model for the operation of both reactor units to comply with the requirements of the SLNPP's National Pollutant Discharge Elimination System (NPDES) permit. The results indicate that the maximum surface temperatures are strongly dependent on ambient ocean conditions. Between 2005 and 2010, the maximum monthly average water temperature observed at the SLNPP intake, which represents ambient ocean water temperatures, was 85.3 °F (29.6 °C). Model assumptions were that the discharge temperature would be at the NPDES permit limit of 115°F (46.1 °C) and that ambient ocean temperature would be 85 °F (29.4 °C). Results indicated that sea-surface temperature would be over 92 °F (33 °C) in an area of less than 0.1 acre (0.04 hec).

2.1.3 Taprogge Condenser Cleaning System

Condensers are heat exchangers that cool exhaust steam to form water; condensers comprise many small tubes that require periodic cleaning. The Taprogge condenser cleaning system uses 1800 23-mm-diameter sponge balls to clean the condenser tubes via physical, instead of chemical, removal of biofouling organisms. A ball strainer system retains the sponge balls and is back flushed, which releases sponge balls into the Atlantic Ocean. The cause of the release is unknown. In 2010, average sponge ball loss was 21 per day. The FPL monitors 2.5 miles of beach outside of sea turtle nesting season and 12 miles of beach during nesting season, and sponge balls are rarely recovered from the beach.

2.2 Action Area

Action area means all areas affected directly, or indirectly, by the Federal action, and not just the immediate area involved in the action (50 CFR § 402.02). For continued SLNPP operation, indirect effects beyond the action area are not anticipated.

The action area consists of SLNPP Units 1 and 2, located on an 1130-acre (457-hectare) site on Hutchinson Island on Florida's east coast, including associated intake and discharge pipelines that terminate in the Atlantic Ocean (Figure 2). The plant and associated cooling water intake structures and canals, are approximately midway between Fort Pierce and St. Lucie Inlets. Indian River Lagoon bounds the SLNPP site to the west, and the Atlantic Ocean is the eastern boundary. The action area extends into the Atlantic Ocean on the eastern side out to the mouth of the intake and discharge pipes and on the western side into the Indian River Lagoon where some additional thermal discharges occur. The island's eastern shoreline is a beach of sand and

shell hash and has occasional rocky promontories on the southern portion. Coastal substrate near SLNPP is sandy with shell pieces, and coquinoid rock formations occur farther offshore and parallel to the beach.

2.3 Interrelated and Interdependent Activities

Interrelated activities are those that are part of a larger action and depend on the larger action for their justification. Interdependent activities are those that have no independent utility apart from the action under consideration. No interrelated or interdependent activities exist for the action of continued operation of SLNPP.

3 Approach to the Assessment

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions either are not likely to jeopardize the continued existence of endangered or threatened species; or adversely modify or destroy their designated critical habitat. NMFS uses a step-wise approach for section 7 analyses. The first step identifies the spatiotemporal extent of the *action area* and aspects of proposed actions that are likely to have direct and indirect physical, chemical, and biotic effects on listed species, designated critical habitat, or the physical, chemical, and biotic environment of an action area. The second step identifies the ESA-listed resources that are likely to be affected by the proposed action (i.e., *exposure analyses*). Next, NMFS examines the scientific and commercial data available to determine whether and how those listed resources are likely to respond given their exposure (i.e., *response analyses*). The final step is to evaluate the risks those responses pose to listed resources individually (i.e., *risk analyses*). When data are absent or uncertainty exists, decisions are conservative. Jeopardy determinations must be based on an action's effects on the continued existence of threatened or endangered species, and destruction or adverse modification determinations must be based on an action's effect on designated critical habitat features that are essential for recovery of the ESA-listed species.

"To jeopardize the continued existence of a listed species" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02). The jeopardy analysis considers both survival and recovery of the species.

"Destruction of adverse modification" means a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species (50 CFR § 402.02). The adverse modification analysis considers the impacts on the conservation value of designated critical habitat including, but not limited to, alterations of the quality and quantity of essential physical or biological features.

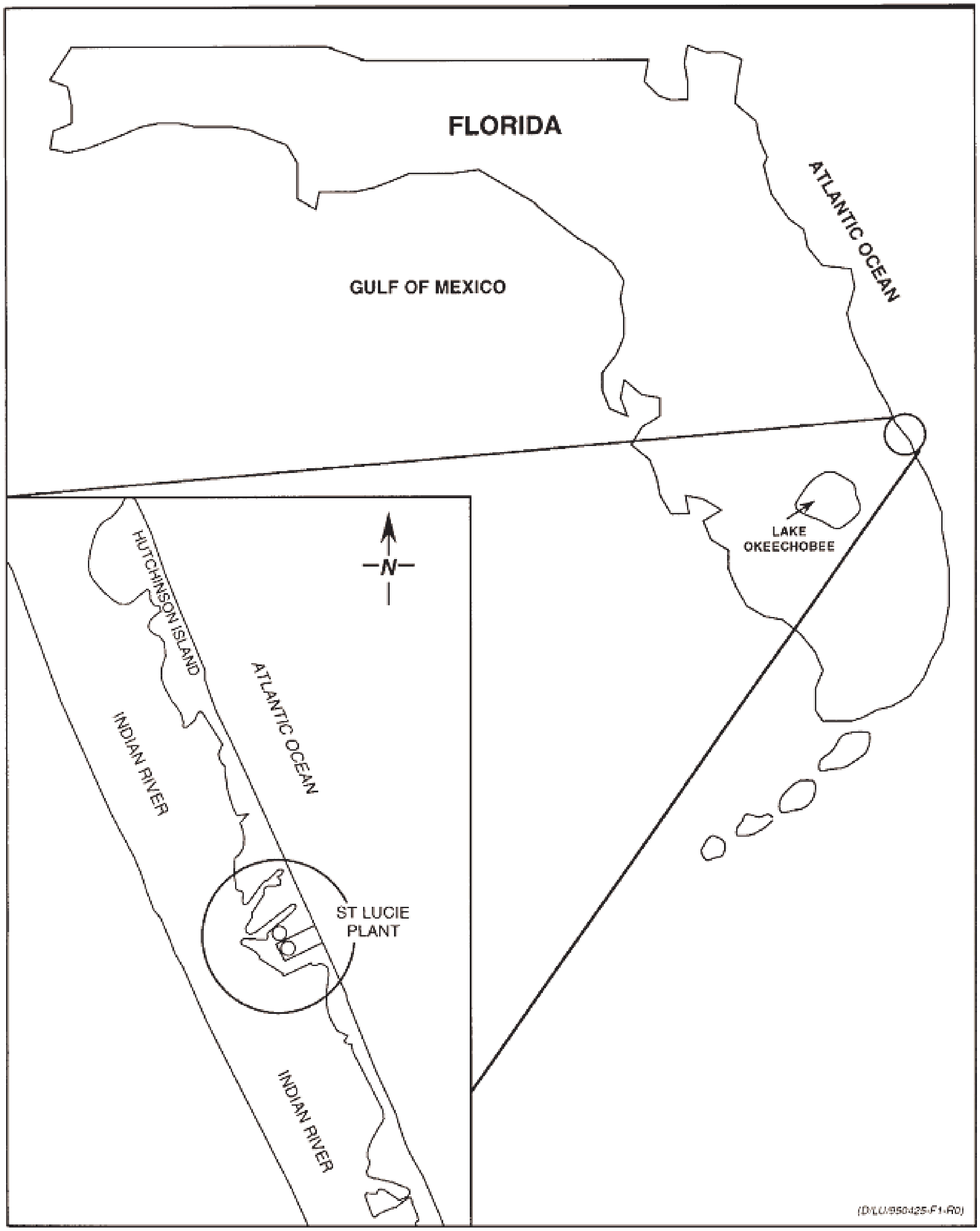


Figure 2. Location of SLNPP. Action area is SLNPP site and small adjacent portion of the Atlantic Ocean. Source: NRC 2006.

4 Status of Listed Resources

The continued operation of SLNPP is likely to affect five species of sea turtles and may affect the smalltooth sawfish (Table 1). Other ESA-listed species may occur near the action area but likely do not occur close enough to the pipeline intakes or discharges to be affected.

Table 1. ESA-listed Species and Critical Habitat that May be Affected by Continued Operation of St. Lucie Units 1 and 2.

Species	ESA Status	Critical Habitat
Sea Turtles		
Green Turtle (*Chelonia mydas*)	E/T[1] – 43 FR 32800	63 FR 46693
Hawksbill Turtle (*Eretmochelys imbricata)*	E – 35 FR 8491	63 FR 46693
Kemp's Ridley Turtle (*Lepidochelys kempii*)	E – 35 FR 18319	-- --
Leatherback Turtle (*Dermochelys coriacea*)	E – 35 FR 8491	44 FR 17710
Loggerhead Turtle (*Caretta caretta*) – Northwest Atlantic Ocean Distinct Population Segment	T – 76 FR 58868	79 FR 39856
Fish		
Smalltooth Sawfish (*Pristis pectinata*)	E – 68 FR 15674	74 FR 45353

[1] E=endangered; T=threatened. Green turtles are threatened except for Florida and Pacific Mexican breeding populations, which are endangered.

During the consultation NMFS examined the status of each species that would be affected by the proposed action. The status is determined by the level of risk that each listed species faces, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR § 402.02. More detailed information on the status and trends of these listed resources, and their biology and ecology can be found in the listing regulations and critical habitat designations published in the Federal Register, status reviews, recovery plans, and on the NMFS website.

NMFS examined the condition of designated critical habitat throughout the designated area, evaluated the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discussed the current function of the essential physical and

biological features that help form that conservation value. The only designated critical habitat that occurs in the vicinity of the action area is for the Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead sea turtle.

4.1 Green Sea Turtle

Green turtles are distinguished from other sea turtles by their smooth carapace with four pairs of costal scutes, a single pair of prefrontal scales, four post-orbital scales, serrated upper and lower jaws, and a small head (Figure 3). Adult green turtles have a light to dark brown, heart-shaped carapace, occasionally with olive shading, and can exceed one meter in carapace length and 200 kg in body mass.

Figure 3. Green sea turtle (*Chelonia mydas*).

Credit: Andy Bruckner, NOAA.

4.1.1 Status and Trends

The green sea turtle was Federally listed under the ESA on July 28, 1978, with all populations listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are endangered (43 FR 32800). The most recent 5-year review of the green turtle indicated that the populations should not be delisted or reclassified but that a review should be conducted to determine applicability of DPSs to the species (NMFS and USFWS 2007a). On March 23, 2015, NMFS and USFWS proposed to replace the current listing applicable to the entire range with a listing of eight DPSs as threatened and three DPSs as endangered for the green sea turtle (80 FR 15271). Concurrent with the proposed listings, NMFS and USFWS proposed to maintain the existing designated critical habitat as designated critical habitat for the North Atlantic DPS. The designated critical habitat for the green sea turtle is around Culebra Island, Puerto Rico and

is not near the action area. The International Union for Conservation of Nature (IUCN) classifies the green turtle as "endangered."

A conservative estimate of mature females nesting annually indicates a 48-67 percent decline over the last three generations, but the actual decline might exceed 70 percent (Seminoff 2004). A more recent analysis of 26 threatened nesting concentrations that are likely representative of the overall trends for their respective regions showed that 12 nesting populations are increasing, 10 are stable, and 4 are decreasing (NMFS and USFWS 2007a). The review cautioned that despite the apparent global increase in numbers, the positive overall trend should be viewed cautiously since trend data are available for just over half of all sites examined. Nesting populations are doing relatively well in the Pacific, Western Atlantic, and Central Atlantic Ocean but are doing relatively poorly in Southeast Asia, Eastern Indian Ocean, and perhaps the Mediterranean (NMFS and USFWS 2007a).

4.1.2 Distribution

Green turtles are found throughout the world, occurring primarily in tropical waters, and to a lesser extent, subtropical and temperate waters. Green turtles appear to prefer waters that usually remain around 20º C in the coldest month but may occur considerably north of these regions during warm-water events, such as El Niño. The species occurs in five major regions: the Pacific Ocean, Atlantic Ocean, Indian Ocean, Caribbean Sea, and Mediterranean Sea. These regions can be further divided into nesting aggregations within the eastern, central, and western Pacific Ocean; the western, northern, and eastern Indian Ocean; Mediterranean Sea; and eastern, southern, and western Atlantic Ocean, including the Caribbean Sea. Primary nesting aggregations (i.e., sites with greater than 500 nesting females per year) of green turtles occur at Ascensión Island (south Atlantic Ocean), Australia, Brazil, Caribbean Islands, Comoros Islands, Costa Rica, Ecuador (Galapagos Archipelago), Equatorial Guinea (Bioko Island), Guinea-Gissau (Bijagos Archipelago), Iles Eparses Islands (Tromelin Island, Europa Island), Indonesia, Malaysia, Mexico, Myanmar, Oman, Philippines, Saudi Arabia, Seychelles Islands, Suriname, and United States (Florida and Hawaii) (Seminoff 2002; NMFS and USFWS 2015).

The majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995). Green sea turtle nesting at monitored beaches in Florida shows mostly biennial peaks in abundance with a generally positive trend during monitoring from 1989 to 2015; the pattern may reflect effectiveness of increased protective legislation throughout the Caribbean (Meylan et al. 1995; FWC 2015). Three record highs are in 2011, 2013, and 2015; 2013 counts were more than twice those of 2011 (FWC 2015). A total statewide average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006, with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida

beaches, as well as the beaches on the Florida Panhandle (Meylan et al. 1995). More recently, green turtle nesting occurred on Bald Head Island, North Carolina; just east of the mouth of the Cape Fear River; on Onslow Island; and on Cape Hatteras National Seashore. Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). According to model results, the Florida nesting stock at the Archie Carr National Wildlife Refuge grows 13.9 percent annually (Chaloupka et al. 2008).

Green turtles spend most of their time in coastal foraging areas (NMFS and USFWS 2015). In the southeastern United States these areas include any coastal shallow waters having macroalgae or seagrasses. Such habitat includes areas near mainland coastlines, islands, reefs, or shelves, as well as open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (NMFS and USFWS 1991; Hirth 1997). In the western Atlantic, important foraging areas include the Mosquito Lagoon and Indian River Lagoon systems, nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, and other nearshore areas off Florida from Brevard though Broward Counties (Guseman and Ehrhart 1992; Wershoven and Wershoven 1992; Hirth 1997). Although in-water abundance estimates are not reliable, a significant increase in the Indian River Lagoon area was observed in recent years (Ehrhart et al. 2007). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs, but some juveniles and adults utilize oceanic habitats for migrating and occasionally for feeding (NMFS and USFWS 2015).

4.1.3 Reproduction and Life History

Sea turtles are long-lived species with delayed maturity and large numbers of eggs and hatchling that have low survival rates as a result of predation, environmental variation, and individual fitness (Crouse 1999). Adult survivorship ranges from 0.82-0.97 versus 0.58-0.89 for juveniles (Seminoff et al. 2003; Chaloupka and Limpus 2005; Troëng and Chaloupka 2007); lower values coincide with areas subject to anthropogenic disturbance (Bjorndal et al. 2003). Despite low abundances of mature individuals, they have higher fitness than early life stages. Therefore, persistence of long-lived species with delayed maturity would be most vulnerable to impacts that preclude individuals from attaining age and sexual maturity. Sexual maturity for green sea turtles is longer than that of other sea turtle species and ranges from about 25 to 50 years (Chaloupka and Musick 1997; Hirth 1997; Limpus and Chaloupka 1997; Zug and Glor 1998; Zug et al. 2002; Chaloupka et al. 2004). Estimates of reproductive longevity range from 17 to 23 years (Carr et al. 1978; Fitzsimmons et al. 1995; Chaloupka et al. 2004).

In waters off nesting beaches, females mate every 2 to 5 years, but males mate every year (Balazs 1983; Hirth 1997). Each nesting female deposits up to seven clutches every couple of weeks during breeding season. Mean clutch size varies among populations but averages about

100 eggs per nest. Precipitation, proximity to the high tide line, and nest depth can significantly affect nesting success (Cheng et al. 2009). During years of heavy nesting activity, density-dependent factors (e.g. beach crowding and digging up of eggs by nesting females) may affect hatchling production (Tiwari et al. 2005; Tiwari et al. 2006). Precipitation can be significant in sex determination with greater nest moisture resulting in a higher proportion of males (Leblanc and Wibbels 2009), and incubation temperature likely affects size of green turtles with higher temperatures resulting in smaller hatchlings (Glenn et al. 2003). Hatchlings emerge at night and orient toward a light source, such as light shining off the ocean. They enter the sea in a frenzy of swimming activity, which decreases rapidly in the first few hours and gradually over the first several weeks (Ischer et al. 2009; Okuyama et al. 2009). During a post-hatchling pelagic stage, green turtles associate with algae and other debris, and juveniles leave pelagic habitats for benthic foraging areas when they reach about 20-25 cm in carapace length (Bjorndal 1997). Adult females often return to the same foraging areas following nesting migrations (Broderick et al. 2006; Godley et al. 2002).

4.1.4 Diet

In coastal foraging grounds, green sea turtles rely on marine algae and seagrass as their primary dietary constituents. However, while offshore and sometimes in coastal habitats, green sea turtles are not obligate herbivores but consume invertebrates such as jellyfish, sponges, sea pens, and pelagic prey (Hatase et al. 2006; Heithaus and Lawrence 2002; Seminoff et al. 2002). A shift to a more herbivorous diet occurs when individuals move into neritic habitats (Cardona et al. 2010). This transition may occur rapidly starting at 30 cm in carapace length, but animal prey continue to constitute an important nutritional component until individuals reach about 62 cm (Cardona et al. 2010).

4.1.5 Migration

Green sea turtles are highly mobile and undertake complex movements through geographically disparate habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). After hatchlings depart the beach for pelagic areas, green turtles reside in a variety of marine habitats for 40 or more years (Limpus and Chaloupka 1997). When juveniles reach about 20 to 25 cm in carapace length, they leave pelagic habitats and enter coastal foraging grounds (Bjorndal 1997). Developmental habitat in the western Atlantic includes estuaries and nearshore waters from North Carolina to Long Island (Musick and Limpus 1997). Breeding occurs in coastal waters off nesting beaches, and adult females return to the same beach from which they hatched to lay eggs (Carr et al. 1978; Meylan et al. 1990).

4.1.6 Diving Behavior

Based on the behavior of post-hatchlings and juvenile green turtles raised in captivity, those in pelagic habitats likely live and feed at or near the ocean surface, and their dives likely do not

normally exceed several meters (NMFS and USFWS 1998a). In Australia, green sea turtles rarely dive deep, staying in upper 8 m of the water column (Hazel et al. 2009). Dives during the day are shallower and shorter than those at night. Also, time spent resting and dive duration increased significantly with decreases in seasonal water temperatures. Green sea turtles along Taiwan may rest during long, shallow dives, and dives by females may be shorter in the period leading up to nesting (I-Jiunn 2009). The maximum recorded dive depth for an adult green turtle is 110 m (Berkson 1967), while sub-adults routinely dive 20 m for 9-23 minutes, with a maximum recorded dive of 66 minutes (Brill et al. 1995).

4.1.7 Threats

Threats to green sea turtles include incidental capture by fisheries, habitat modification and loss, disease, predation, and harvest of eggs, subadults, and adults. Mortality from fisheries bycatch and other human activities occurs widely. Sea sampling coverage in the pelagic driftnet, pelagic longline, Southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded takes of green turtles. Also, beach erosion, coastal development, contamination, in-water structural degradation, and climate change contribute to habitat modification and loss. The presence of lights on or adjacent to nesting beaches alters the behavior of nesting adults (Witherington 1992) and is often fatal to emerging hatchlings as they are attracted to light sources and drawn away from the water (Witherington and Bjorndal 1991). Ingestion of plastic and other marine debris is another source of morbidity and mortality (Stamper et al. 2009).

When water temperatures drop rapidly, green sea turtles experience cold stunning that affects their ability to swim and dive and occasionally leads to death (Milton and Lutz 2003). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead, or dying after they were gathered. Another cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,500 green turtles found cold-stunned off Texas, and another 300 or so off Mexico, with an as yet undetermined number found dead or dying after they were found. Additionally, the long-term impacts from the 2010 Deepwater Horizon oil spill to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.

Diseases also threaten a large number of subpopulations; the most commonly identified disease in green turtles is fibropapillomatosis (NMFS and USFWS 2007a). Green sea turtles with many barnacles have a high probability of health concerns (Flint et al. 2009). Poaching of eggs and killing of turtles, for meat and the illegal shell trade, continue to threaten subpopulations in many areas throughout their range (NMFS and USFWS 2007a). Additionally, dogs, pigs, rats, crabs, sea birds, reef fishes, and sharks prey upon eggs and/or hatchlings, and sharks and killer whales

prey upon juveniles and adults (Witzell 1981). Global climate change causes broad-reaching effects, such as sea-level rise, increased frequency and intensity of severe weather events, and air and water temperature changes. Sea-level rise would reduce available nesting habitat in low-lying areas, severe storms could erode nesting beaches, and temperature changes affect sea turtle hatchling size ratios. Global climate change could alter the distribution and abundance of prey through changes in marine ecosystem parameters such as salinity, dissolved oxygen concentration, nutrients, and current patterns. All of these threats combine to contribute noticeably to green sea turtle population declines.

4.2 Hawksbill Sea Turtle

The hawksbill is a small to medium-sized marine turtle with a mottled brown shell and an elongate head that tapers to a point (Figure 4). The turtle has two pairs of prefrontal scales; typically four pairs of inframarginals scales; thick, posteriorly overlapping scutes on the carapace; four pairs of costal scutes (the anterior-most are not in contact with the nuchal scute); two claws on each flipper; and a beak-like mouth. The scales of the head and forelimbs are dark brown or black and have sharply defined yellow borders. The carapace is heart-shaped in very young turtles and becomes more elongate or subovate with maturity. The lateral and posterior carapace margins are sharply serrated in all but very old individuals. Scutes are often richly patterned with irregularly radiating streaks of brown and black on an amber background. The soft skin on the hawksbill's venter is cream or yellow and may be pinkish-orange in mature individuals.

Nesting females average about 87 cm in curved carapace length, and weight may be up to 80 kg in the Caribbean, with a record weight of 127 kg (Carr 1952). Hatchlings in the U.S. Caribbean average about 42 mm in straight carapace length and range in weight from 13.5 to 19.5 g.

4.2.1 Status and Trends

Hawksbill sea turtles received protection on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act and since 1973 have been listed as endangered under the ESA. The designated critical habitat for the hawksbill sea turtle is around Mona Island, Puerto Rico and is not near the action area. The IUCN considers the species "Critically Endangered" based on global population declines of over 80 percent during the past three generations (Meylan and Donnelly 1999).

Figure 4. Hawksbill sea turtle (*Eretmochelys imbricata*).

Credit: Johan Chevalier.

Long-term trend data at foraging sites are few primarily because these data are logistically difficult and relatively expensive to obtain. As with green sea turtles, the primary information source for evaluating trends in global hawksbill populations is nesting beach data. The Pacific Ocean has more nesting hawksbills than the Atlantic or Indian Oceans, but the nesting abundance and population trend in the Pacific is declining severely (NMFS and USFWS 2007b). Although no historical records of abundance are known, hawksbill sea turtles are considered to be severely depleted due to the fragmentation and low use of current nesting beaches (NMFS and USFWS 2007b). The five regional nesting populations with more than 1,000 females nesting annually are in the Seychelles, Mexico, Indonesia, and two in Australia (Meylan and Donnelly 1999). Worldwide, an estimated 21,212-28,138 hawksbills nest each year among 83 sites. Among the 58 sites for with historic trends, all show a decline during the past 20 to 100 years. Among 42 sites for which recent trend data are available, 10 (24 percent) are increasing, three (7 percent) are stable, and 29 (69 percent) are decreasing. Overexploitation has almost eliminated several nesting sites that now have fewer than ten nesting females annually (NMFS and USFWS 2013a). The nesting range along Mexico and Central America appears not to have contracted, and estimates continue to increase as additional dedicated study is conducted in the eastern Pacific (Gaos et al. 2010).

4.2.2 Distribution

The hawksbill sea turtle occurs in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. Hawksbills are the most tropical sea turtle species, ranging from approximately 30°N to 30°S latitude. They are closely associated with coral reefs and other hardbottom habitats, but they are also found in other habitats including inlets, bays and coastal lagoons (NMFS and USFWS 1993).

Within the Central Pacific, nesting is widely distributed but in very low numbers. Foraging hawksbills occur near all the island groups of Oceania from the Galapagos Islands in the eastern Pacific to the Republic of Palau in the western Pacific (Witzell 1983; Pritchard 1982). American Samoa and Western Samoa host fewer than 30 females annually (Tuato'o-Bartley et al. 1993; Grant et al. 1997). Guam and Hawaii each have only 5-10 nesting females annually, but the Hawaiian population shows signs of a potential increasing trend (NMFS and USFWS 2007b). Along the far western and southwestern Pacific coasts, hawksbills nest on the islands and mainland of southeastern Asia from China and Japan, throughout the Philippines, Malaysia, and Indonesia, to Papua New Guinea (PNG), the Solomon Islands, and northeastern Australia (McKeown 1977; Limpus 1982). Additional populations are known from the eastern Pacific potentially extending from Mexico through Panama.

Hawksbills are rare in the eastern Atlantic and do not occur in the Mediterranean Sea. The largest nesting population in the western Atlantic occurs on Mexico's Yucatán Peninsula (Garduño-Andrade et al. 1999). Nesting also occurs in Antigua, Barbados, Costa Rica, Cuba, Jamaica, and the United States (Puerto Rico, U.S. Virgin Islands, and southeastern Florida) (Meylan 1999a). Foraging and migrating hawksbills have also been observed throughout the Gulf of Mexico and occasionally along the U.S. east coast north to Massachusetts.

4.2.3 Reproduction and Life History

The best estimate of age at sexual maturity for hawksbill sea turtles is about 20-40 years (Chaloupka and Limpus 1997; Crouse 1999). Reproductive females may exhibit a high degree of fidelity to their nest sites, and they nest an average of three to five times per season at regular intervals (Richardson and Richardson 1999). Between nesting events within a breeding season, females do not move far from the nesting beach (NMFS and USFWS 2013a). Average clutch size (about 250 eggs) is higher than that of green turtles (Hirth 1980). Nest temperature affects the sex ratio of hatchlings with warmer temperature producing more females (Wibbels 2003).

Once hawksbill hatchlings leave the beach, they are pelagic and likely carried long distances by surface gyres (Meylan 1988; Meylan and Donnelly 1999). Hatchlings and small juveniles (5-21 cm straight carapace length) have been found in association with *Sargassum* in both the Atlantic and Pacific Oceans (Musick and Limpus 1997). When juveniles reach about 30-35 cm straight carapace length, they settle in neritic foraging and developmental habitats including coral reefs or other hard-bottom habitats, sea grass, algal beds, and mangrove bays and creeks (Musick and Limpus 1997; Bjorndal and Bolten 2010). Some larger juveniles may associate with the same feeding locality for more than a decade while others are highly migratory between sites (Musick and Limpus 1997; NMFS and USFWS 2013a). Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs but occasionally includes other hard-

bottom communities and mangrove-fringed bays. Larger individuals may prefer deeper habitats than smaller hawksbills (Blumenthal et al. 2009).

4.2.4 Diet

Pelagic hatchlings eat *Sargassum* and its associated flora and fauna, and juveniles and adults shift to benthic feeding, predominantly on sponges although evidence suggests a more omnivorous diet in the Indo-Pacific (NMFS and USFWS 1998b; NMFS and USFWS 2007b). Hawaiian and Caribbean hawksbills are specialist sponge carnivores and eat just a few genera of sponges (Meylan 1988; Vicente 1994). Much of the other material found in hawksbill stomachs appears to have been ingested coincidentally while the animal was feeding on sponges.

4.2.5 Migration

Hawksbill sea turtles are highly migratory and use a wide range of broadly separated localities and habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Hawksbills undertake developmental and reproductive migrations that may span hundreds or thousands of kilometers (Meylan 1999b). Reproductive females periodically migrate to their natal beach to nest. Movements of reproductive males are less well known but are presumed to involve migrations to the nesting beach or to courtship stations along the migratory corridor.

4.2.6 Diving Behavior

Hawksbills have long dive durations, but dives are not particularly deep. Diving ability varies with age and body size. As individuals increase with age, dive duration and depth increase (Blumenthal et al. 2009). Caribbean hawksbills have diurnal diving behavior with dives lasting almost double the length of night dives (van Dam and Diez 1997; Blumenthal et al. 2009). Daytime dives averaged 5 m in depth, and nighttime dives averaged 43 m (Blumenthal et al. 2009). Adult females along St. Croix reportedly have average dive times of 56 min, with a maximum time of 73.5 min (Starbird et al. 1999). Typical day and night dive times were 34–65 and 42–74 min, respectively. Immature individuals have much shorter dives of 8.6–14 min to a mean depth of 4.7 m while foraging (van Dam and Diez 1997).

4.2.7 Threats

Threats to hawksbill sea turtles are similar to those for other sea turtles and include incidental capture by fisheries, habitat modification and loss, disease, predation, and harvest of eggs, subadults, and adults. Although hawksbills are subject to the suite of threats that affect other marine turtles, the decline of the species is primarily attributed to centuries of exploitation for tortoise shell, the beautifully patterned scales that cover the turtle's shell (Parsons 1972). Hawkbills' predictable nesting sites and timing make them vulnerable to capture on the nesting beach. Poaching of eggs and killing of turtles continue to threaten populations in many areas (NMFS and USFWS 2007b). Also, because hawksbills prefer to nest under vegetation (Mortimer

1982; Horrocks and Scott 1991), they are particularly affected by beachfront development and clearing of dune vegetation. At sea, hawksbills are typically associated with coral reefs, which are among the world's most endangered marine ecosystems (Wilkinson 2002). Finally, climate change will likely affect the sea turtle environment (e.g., nesting habitat) and availability of food as described for green turtles in section 4.1.7. Because hawksbills exhibit temperature-dependent sex determination, climate change may induce a female bias to the hawksbill populations.

4.3 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle is the smallest marine turtle in the world; an adult weighs about 100 lbs (45 kg). The round carapace is greenish gray on top with a light yellow underside (Figure 5). The turtle has 2 pairs of prefrontal scales, 5 vertebral scutes, 5 pairs of costal scutes, 12 pairs of marginal scutes, one claw on front flippers, and one to two claws on back flippers. Unlike other sea turtles, Kemp's ridleys often nest during the day, and they exhibit synchronized nesting in large aggregations, called arribadas, which are unique to the genus *Lepidochelys*.

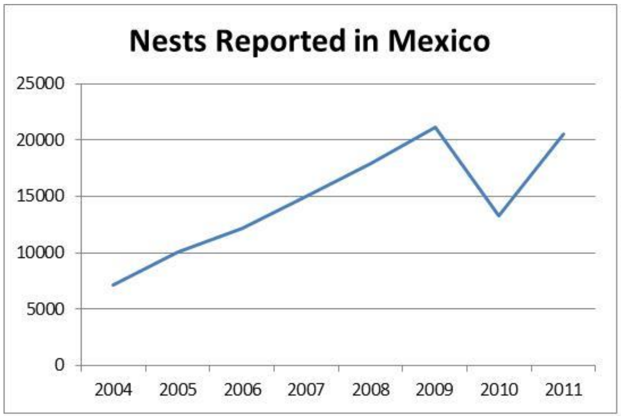
Figure 5. Kemp's ridley sea turtle (*Lepidochelys kempii*).

Credit: National Park Service.

4.3.1 Status and Trends

The Kemp's ridley was listed as endangered on December 2, 1970 (35 FR 18319) under the Endangered Species Conservation Act and since 1973 have been listed as endangered under the ESA. Kemp's ridley sea turtle does not currently have designated critical habitat. The IUCN considers the species "Critically Endangered" (Marine Turtle Specialist Group 1996b). Internationally, the Kemp's ridley is considered the most endangered sea turtle (Groombridge 1982; TEWG 2000).

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most adult females nest in arribadas on the Rancho Nuevo beaches in Tamaulipas, Mexico; other primary nesting beaches are Tepehuajes and Playa Dos, which are also in Tamaulipas, Mexico (NMFS et al. 2011). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid 1980s, nesting numbers were below 1,000 (with a low of 702 nests in 1985). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999 (TEWG 2000). A small nesting population is also emerging in Texas as a result of an international recovery project at Padre Island National Seashore. Nesting declines and recoveries, while at different scales, follow similar patterns in Mexico and Texas (Figure 6). Although nests substantially declined in 2010, 2013, and 2014, the general trend of increasing nests over the past decade remains positive.



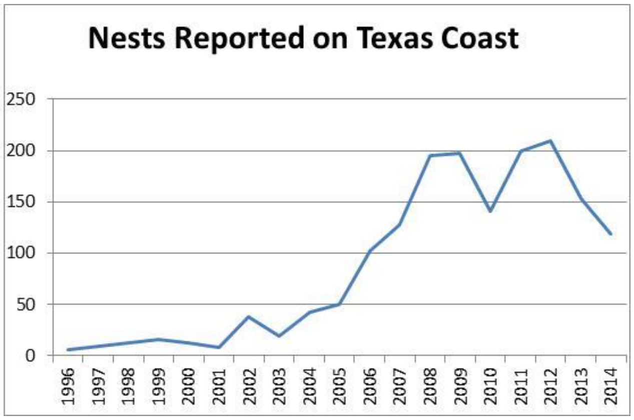


Figure 6. Kemp's ridley nesting trends.

Data source: NPS 2014.

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of turtle excluder devices in the U.S. and Mexican shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade.

4.3.2 Distribution

Beyond the primary nesting in Tamaulipas and secondary nesting in Texas, Kemp's ridley sea turtles occur mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Juveniles either remain in the Gulf of Mexico or travel to the northwestern Atlantic (NMFS et al. 2011), and a few individuals reach European waters (Brongersma 1972). Kemp's ridleys are the

second most abundant sea turtle in Virginia and Maryland waters (Keinath et al. 1987; Musick and Limpus 1997). Adults of this species are usually confined to the Gulf of Mexico, but some individuals are in waters off the U.S. east coast. Post-nesting adult females exhibit site fidelity to nearshore foraging areas, particularly those off the Louisiana coast and Yucatan Peninsula (Shaver et al. 2013).

4.3.3 Reproduction and Life History

Kemp's ridleys reach maturity at 7-15 years of age. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting usually occurs during the day from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridley sea turtles is 100 eggs/nest, with an average of 2.5 nests/female/season. Similar to the hawksbill, nest incubation temperature determines sex of hatchlings.

Guided by the waves, hatchlings emerge at night or dawn, crawl to the surf, and immediately swim offshore in a frenzy. They are entrained in currents and reach the open ocean within four days (NMFS et al. 2011). The pelagic stage likely lasts two years but could extend to four or more years (Schmid and Witzell 1997; NMFS et al. 2011). Next, the benthic immature stage lasts seven to nine years when benthic immature Kemp's ridleys have been found in neritic zones of the Gulf of Mexico and along the U.S. eastern seaboard where juveniles frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Finally, adults spend most of their time in shallow, nearshore waters. Little information exists regarding breeding areas.

4.3.4 Diet

Pelagic stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the Gulf of Mexico. Juvenile and adult Kemp's ridleys consume a variety of crab species, including *Callinectes* spp., *Ovalipes* spp., *Libinia* spp., and *Cancer* spp.; mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Immature Kemp's ridleys off southwestern Florida ate benthic tunicates, a previously undocumented food source for this species (Witzell and Schmid 2005). Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991).

4.3.5 Migration

Little is known of the movements of the post-hatchling stage (pelagic stage) within the Gulf of Mexico. Benthic immature Kemp's ridleys in the northern Gulf of Mexico likely stay in shallow, warm, nearshore waters until lowering temperatures trigger movement offshore or south along the Florida coast (Renaud 1995). Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, and

they move southward with the onset of winter (Lutcavage and Musick 1985; Henwood and Ogren 1987; Ogren 1989). Females routinely migrate between foraging and nesting areas; the mean migratory distance is 795 km (Shaver et al. 2013). Male migration patterns are not well understood, but some data indicate that males may remain in nearshore, shallow waters year-round without undergoing migration (Shaver et al. 2005).

4.3.6 Diving Behavior

Hatchlings likely dive under waves to facilitate movement offshore via seaward water movement near the bottom (NMFS et al. 2011). Juvenile and adult Kemp's ridleys are generally shallow divers even when in deep waters, and dive times are likely longer at night and during the winter (NMFS et al. 2011).

4.3.7 Threats

Kemp's ridleys face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, natural predators at sea, oceanic events such as cold-stunning, and anthropogenic impacts. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. Many cold-stunned sea turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality. Nearshore areas in the northern Gulf of Mexico are primary foraging sites for the Kemp's ridley and are also areas experiencing many anthropogenic impacts, such as intense fishing pressure, oil production, dredging, and hypoxia.

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed in previous sections. For example, in the spring of 2000, a total of 5 Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the sea turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The five Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

The impacts of pollution on Kemp's ridley sea turtles, as with all sea turtles, are still poorly understood. Official estimates from the 2010 Deepwater Horizon oil spill indicate that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. The close proximity of the spill to known Kemp's ridley foraging sites may hinder the species's recovery. Additionally, the long-term impacts to sea turtles as a result of habitat

impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.

Habitat modification and loss could affect significant foraging areas and prey availability. Because Kemp's ridleys consume benthic animals, dredging could have substantial effects on prey resources. Also, hypoxia, which is known to occur annually in the northern Gulf of Mexico, could reduce prey availability as a result of lack of adequate dissolved oxygen for the crabs and other prey species in the foraging grounds.

Global climate change results in sea-level rise, increased frequency and severity of severe weather events, and change in air and water temperatures (IPCC 2007). Such effects may skew the hatchling sex ratios of Kemp's ridley sea turtles toward more females (Wibbels 2003; NMFS and USFWS 2007c). Additionally, increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea-level rise could inundate nesting sites on low-lying beaches and decrease available nesting habitat (Daniels et al. 1993; Fish et al. 2005; Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006; Baker et al. 2006). Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, forage fish, etc., which could ultimately affect the primary foraging areas of Kemp's ridley sea turtles.

4.4 Leatherback Sea Turtle

The leatherback is the largest living sea turtle. The black carapace is about 4 cm thick and made primarily of tough, oil-saturated connective tissue raised into seven prominent longitudinal ridges that taper to a blunt point posteriorly (Figure 7). The front flippers are proportionally longer than in other sea turtles and may span 270 cm in an adult. The curved carapace length for an adult female ranges from approximately 120 cm to 180 cm. The mean curved carapace length for adult females nesting in the U.S. Caribbean is 155 cm. Nesting female weight ranges between 200 kg and 700 kg, and the largest leatherback on record was a male weighing 916 kg. Hatchlings are dorsally mostly black and covered with tiny polygonal or bead-like scales; the flippers are margined in white, and rows of white scales appear as stripes along the length of the back. In the U.S. Virgin Islands, hatchlings average 61.3 mm in straight carapace length and 45.8 g in weight.

Figure 7. Leatherback sea turtle (*Dermochelys coriacea*).

Credit: Scott R. Benson, NMFS Southwest Fisheries Science Center.

4.4.1 Status and Trends

Leatherback sea turtles received protection on June 2, 1970 (35 FR 8491) under the Endangered Species Conservation Act and were listed as endangered under the ESA in 1973. Designated critical habitat for the leatherback is off the coasts of St. Croix, California, Oregon, and Washington; thus, the critical habitat is not near the action area. The IUCN considers the species "Vulnerable" and lists the Northwest Atlantic Ocean subpopulation as "Least Concern" (Wallace et al. 2013).

Leatherback nesting worldwide is declining, but the population in the northwestern Atlantic is increasing (Wallace et al. 2013). Estimates of breeding females worldwide vary and continue to be refined (Pritchard 1971; Pritchard 1982; Spotila et al. 1996; Spotila 2004); a recent estimate is 34,000 to 95,000 total adults with 10,000-21,000 nesting females (TEWG 2007). The species as a whole is declining, and local populations are in danger of extinction (NMFS 2001b). North Atlantic leatherbacks likely number 34,000-94,000 individuals, with females numbering 18,800 and the eastern Atlantic segment numbering 4,700, and the Southern Caribbean/Guianas stock has a positive population growth rate (TEWG 2007). Drastic overharvesting of eggs and mortality from interactions with driftnet and longline fisheries are primary causes of the tremendous decline (Eckert 1993; Spotila et al. 1996; Eckert and Sarti 1997; Sarti Martinez et al. 2007). In the Atlantic Ocean, leatherback populations are increasing or stable with exceptions in the western Caribbean Sea and West Africa (NMFS and USFWS 2013b). The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with the vast majority of the nesting occurring in the Guianas and Trinidad. Leatherback nesting on Florida beaches occurs mostly on the east coast of Florida and has increased by over 10 percent since 1979, and that trend seems to be similar to trends on other

northwestern Atlantic beaches (Stewart and Dutton 2011). Like the green turtle nest counts in Florida, leatherback nests counts in Florida have an exponentially increasing trend (FWC 2015). In addition to protections in place at nesting beaches, increased availability of prey (i.e. jellyfish), as a result of overfishing of apex predators, may contribute to the increasing leatherback population in the northwestern Atlantic Ocean.

4.4.2 Distribution

The leatherback is globally distributed and is found throughout waters of the Atlantic Ocean, Pacific Ocean, Indian Ocean, Caribbean Sea, Gulf of Mexico, and the Mediterranean Sea (Ernst and Barbour 1972; Casale et al. 2003; Hamann et al. 2006). Leatherbacks range farther than any other sea turtle species, having evolved physiological and anatomical adaptations that allow them to exploit cold waters (Frair et al. 1972; Greer et al. 1973; NMFS and USFWS 1995). High-latitude leatherback range in the Atlantic includes the North and Barents Seas, Newfoundland and Labrador , Argentina, and South Africa (Threlfall 1978; Goff and Lien 1988; Hughes et al. 1998; NMFS SEFSC 2001; Luschi et al. 2006). Pacific ranges extend to Alaska, Chile, and New Zealand (Brito 1998; Gill 1997; Hodge and Wing 2000).

Leatherbacks are predominantly pelagic but can be found in continental shelf and nearshore waters with 7-27˚ C (CETAP 1982). Aerial surveys off the western U.S. support continental slope waters as having greater leatherback occurrence than shelf waters (Bowlby et al. 1994; Carretta and Forney 1993; Green et al. 1992). Juvenile leatherbacks usually stay in warmer, tropical waters >21˚ C (Eckert 2002). Males and females show some fidelity to annual breeding sites (James et al. 2005). Four general nesting aggregations occur in the Atlantic, Pacific, and Indian Oceans and in the Caribbean Sea. Nesting sites appear to be related to beaches with relatively high exposure to wind or wind-generated waves (Santana Garcon et al. 2010).

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS SEFSC 2001). Female leatherbacks nest from the southeastern U.S. to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NMFS SEFSC 2001). Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) resulted in an earlier determination that within the Atlantic basin there are at least three genetically different nesting populations: the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). Further genetic analyses using microsatellite markers in nuclear DNA along with the mtDNA data and tagging data has resulted in Atlantic Ocean leatherbacks now being divided into seven groups or breeding populations:

Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007).

4.4.3 Reproduction and Life History

Leatherbacks live for over 30 years. Previous estimates for a female leatherback's age at sexual maturity ranged from 5 to 14 years, but more recent analysis indicates that females in the western North Atlantic may reach sexual maturity at 29 years of age (NMFS SEFSC 2001). In the United States, nesting occurs from March to July. Every two to three years females nest up to ten times per season. They produce up to 100 or more eggs per clutch depending on the nesting location, and up to 30 percent of each clutch is infertile. Eggs incubate for 58–65 days (Lux et al. 2003).

Leatherback sex determination is affected by nest temperature, with higher temperatures producing a greater proportion of females (Mrosovsky 1994). A significant female bias exists in all leatherback populations thus far studied. Along the U.S. Atlantic and Gulf of Mexico coasts, 60 percent of individuals were female. Studies of Suriname nesting beach temperatures suggest a female bias in hatchlings, with estimated percentages of females hatched over the course of each season at 75.4, 65.8, and 92.2 percent in 1985, 1986, and 1987, respectively (Plotkin 1995). Likewise, hatchlings from the Pacific coast of Costa Rica were predominantly female, with estimated male to female ratios over three seasons of 0:100, 6.5:93.5, and 25.7:74.3 (Binckley et al. 1998).

4.4.4 Diet

Leatherbacks forage nocturnally in high-invertebrate prey density areas formed by favorable features (Eckert et al. 1989; Ferraroli et al. 2004; Eckert 2006). The location and abundance of prey, including medusae, siphonophores, salpae, and tunicates, in temperate and boreal latitudes likely has a strong influence on leatherback distribution in these areas (Plotkin 1995). Areas above 30º N in the Atlantic appear to be popular foraging locations (Fossette et al. 2009). Mean primary productivity in all foraging areas of western Atlantic females is 150 percent greater than in eastern Pacific waters, likely resulting in twice the reproductive output of eastern Pacific females (Saba et al. 2007).

4.4.5 Migration

Leatherback sea turtles migrate throughout open ocean convergence zones and upwelling areas, along continental margins, and in archipelagic waters throughout boreal, temperate, and tropical regions (Eckert 1998; Eckert 1999). In a single year, a leatherback may swim more than 9,600 km to nesting and foraging areas throughout ocean basins (Eckert 1998; Ferraroli et al. 2004; Hays et al. 2004; Sale et al. 2006; Eckert 2006; Eckert et al. 2006; Benson et al. 2007a; Benson et al. 2007b). Movements are largely dependent upon reproductive and feeding cycles and the oceanographic features that concentrate prey, such as frontal systems, eddy features, current

boundaries, and coastal retention areas (Collard 1990; Benson et al. 2011). Return to nesting beaches may be accomplished by a form of geomagnetic navigation and use of local cues (Sale and Luschi 2009). Females will either remain in nearshore waters between nesting events or range widely, presumably to feed on available prey (Byrne et al. 2009; Fossette et al. 2009). Although migration routes and behavior vary, most leatherbacks from Florida and North Carolina have been tracked in the Gulf of Mexico and northwestern Atlantic, and a few moved across the ocean to western Africa (TEWG 2007).

4.4.6 Diving Behavior

Leatherbacks are deep divers, with recorded depths in excess of 4000 m (López-Mendilaharsu et al. 2009), but the turtles may come into shallow waters if there is an abundance of jellyfish near shore. Dives are typically 50-84 m, and 75-90 percent of dive time is shallower than 80 m (Standora et al. 1984). Two leatherbacks off South Africa were found to spend less than 1 percent of their dive time at depths greater than 200 m, which suggests that most leatherback feeding occurs in the upper 200 m (Hays et al. 2009). Dive typically last 1-14 min but can last as long as 86 min (Eckert et al. 1989; Eckert et al. 1996; Harvey et al. 2006; López-Mendilaharsu et al. 2009). Most of this time is spent traveling to and from maximum depths (Eckert et al. 1989). Dives are continual, with only short stays at the surface (Eckert et al. 1986; Eckert et al. 1989; Southwood et al. 1999). Off Playa Grande, Costa Rica, adult females spent 57–68 percent of their time underwater, diving to a mean depth of 19 m for 7.4 min (Southwood et al. 1999). Off St. Croix, adult females dove to a mean depth of 61.6 m for an average of 9.9 min, and spent an average of 4.9 min at the surface (Eckert et al. 1989). During shallow dives in the South China Sea, dives averaged 6.9–14.5 min, with a maximum of 42 min (Eckert et al. 1996). Off central California, leatherbacks dove to 20–30 m with a maximum of 92 m, corresponding with the vertical prey distribution (Harvey et al. 2006). Leatherbacks dove more shallowly (mean of 53.6 m) and moved more slowly (17.2 km/day) while in foraging areas than while travelling to or from these areas (81.8 m and 51.0 km/day) (Fossette et al. 2009).

4.4.7 Threats

Primary threats to leatherbacks are direct takes via egg collection, harvest of females, habitat loss or modification, and mortality from fisheries interactions. Egg collection is widespread and attributed to catastrophic declines, such as in Malaysia. Harvest of females along nesting beaches is of concern worldwide, and 200 leatherback turtles are estimated to die in direct harvests in Indonesia. As for other sea turtle species, additional threats include vessel strikes, predation, ingestion of marine debris, and effects of global climate change.

Bycatch, particularly by longline fisheries, is a major source of mortality for leatherback sea turtles (Crognale et al. 2008; Fossette et al. 2009; Gless et al. 2008; Petersen et al. 2009). During 2001 to 2005, a Chilean longline fishery incidentally caught 284 leatherbacks (with two observed

mortalities), the most frequently bycaught sea turtle species (Donoso and Dutton 2010). The California/Oregon drift gillnet fishery killed 8-17 leatherback turtles annually during 1990-2000; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; and, before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them annually. Annual bycatch interactions total 1,400 leatherbacks annually for U.S. Atlantic fisheries (resulting in about 40 mortalities) and 100 interactions in U.S. Pacific fisheries (resulting in about 10 mortalities) (Finkbeiner et al. 2011). In 2000, pelagic longline fisheries throughout the Atlantic captured 30,000-60,000 leatherbacks (Lewison et al. 2004). Leatherbacks also get entangled in gillnets, trawls, and lobster, crab, and fish pots and traps (Zollett 2009).

Plastic ingestion is very common in leatherbacks and can block gastrointestinal tracts leading to death (Mrosovsky et al. 2009). Along the coast of Peru, intestinal contents of 13 percent leatherback carcasses contained plastic bags and film (Fritts 1982). Although little is known regarding contaminants, some metals (arsenic, cadmium, copper, mercury, selenium, and zinc) bioaccumulate, and cadmium is found in highest concentration in leatherback tissues versus loggerhead and Kemp's ridley sea turtles (Caurant et al. 1999). A diet of primarily jellyfish, which have high cadmium concentrations, is likely the cause (Caurant et al. 1999). Organochlorine pesticides have been found in leatherbacks (McKenzie et al. 1999), and PCB concentrations in leatherbacks are equivalent to those in some marine mammals (Davenport et al. 1990; Oros et al. 2009).

Global climate change affects leatherbacks in similar ways it affects other sea turtles species. Although global warming may expand foraging habitats into higher latitude waters, increasing temperatures may increase feminization of nests (Mrosovsky et al. 1984; James et al. 2006; McMahon and Hays 2006). Changes in salinity, temperature, circulation patterns, and dissolved oxygen may alter the leatherback's prey availability. Leatherbacks nest closer to the high-tide line than other sea turtle species, and sea-level rise may inundate nests, significantly reducing hatching success (Caut et al. 2010).

4.5 Loggerhead Sea Turtle Northwest Atlantic Ocean Distinct Population Segment (DPS)

The loggerhead is characterized by a reddish brown, bony carapace and a comparatively large head up to 25 cm wide in some adults (Figure 8). They usually have five pairs of costal scutes and three inframarginal scutes without pores. Each forelimb has two claws. Adult males have comparatively narrow shells, gradually tapering posteriorly, and long, thick tales extending well beyond the edge of the carapace. Adults typically weigh between 80 and 150 kg and have an average curved carapace length of about 97 cm (Dodd 1988; Limpus 1985; Eckert 1993). Hatchlings are uniformly gray, reddish, or olive brown.

Figure 8. Loggerhead sea turtle (*Caretta caretta*).
Credit: NOAA Fisheries.

4.5.1 Status and Trends

The loggerhead sea turtle was listed under the ESA as threatened throughout its range on July 28, 1978. On September 22, 2011, NMFS designated nine DPSs of loggerhead sea turtles and listed four DPSs as threatened and five as endangered (76 FR 58868). Northwest Atlantic Ocean, South Atlantic Ocean, Southwest Indo-Pacific Ocean, and Southwest Indian Ocean DPSs are threatened, and Northeast Atlantic Ocean, Mediterranean Sea, North Indian Ocean, North Pacific Ocean, and South Pacific Ocean DPSs are endangered. Each DPS is considered a single "species" under the ESA. The Northwest Atlantic Ocean (NWA) DPS is the only loggerhead "species" in the action area and is the only one analyzed in this biological opinion. The NWA DPS designated critical habitat does occur in the vicinity of the action area (see section 4.5.2). The IUCN lists the loggerhead as "Endangered" (Marine Turtle Specialist Group 1996a).

The NWA DPS recovery units, all of which are essential for recovery of the species, are: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (76 FR 58868).

Analysis of nesting data reveals a fluctuating trend, and the current long-term trend for the NWA DPS, for 1989-2010, indicates a very slight population decline (76 FR 58868). The recovery units within the NWA DPS experienced different trends.

The Northern Recovery Unit (NRU) averaged 5,215 nests annually from 1989-2008. The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3 percent

annually. The 40-year time-series trend data show an overall decline in nesting, but the shorter comprehensive survey data (20 years) indicate a stable population (SCDNR 2008). The NRU produced 65 percent males (NMFS SEFSC 2001). Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the NRU is related to the number of female hatchlings that are produced.

The Peninsular Florida Recovery Unit (PFRU) has the largest loggerhead nesting assemblage in the NWA DPS contributed close to 90 percent of nests to the DPS (Ehrhart et al. 2014). Most PFRU nests are on four Atlantic beaches and one Gulf of Mexico beach, and among those, the most significant nesting beach is the northern end of the Archie Carr National Wildlife Refuge (ACNWR), which is almost 50 mi north of SLNPP. For data from 2001 to 2010, nests at ACNWR represented 14.5 percent of all nests of the NWA DPS (Ehrhart et al. 2014). A near-complete nest census from 1989 to 2007 showed an annual mean of 64,513 loggerhead nests, representing approximately 15,735 nesting females per year (NMFS and USFWS 2009). An analysis of index nesting beach data shows a 26 percent decline in nesting by the PFRU between 1989 and 2008, and a mean annual rate of decline of 1.6 percent despite a large increase in nesting for 2008 (NMFS and USFWS 2009; Witherington et al. 2009). A decline in the number of adult females in the PFRU is the likely cause of the significant decline in nests (Witherington et al. 2009). Successive data through 2012 indicate that the nesting trend for the PFRU may be on the rise again.

The remaining three recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—have much smaller nesting assemblages but are still considered essential to the continued existence of the NWA DPS. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. From 1995-2004, annual nest counts ranged from 168-270 with a mean of 246, but with no trend was detectable (NMFS and USFWS 2009). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. The 12-year dataset (1997-2008) of index nesting beaches in the area shows a significant declining trend of 4.7 percent annually (NMFS and USFWS 2009). For the GCRU, nesting survey effort has been inconsistent, and no trend can be determined for this subpopulation. During 1987-2001, a statistically significant increase in the number of nests occurred on seven beaches in Quintana Roo, Mexico (Zurita et al. 2003). However, nesting in Quintana Roo has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2009).

The implication of the nesting decline data is confounded by the recent increase of neritic juvenile loggerhead abundance in the southeastern United States (Ehrhart et al. 2007). Comparison between datasets from 1950s through 1990s and the data from 2000-2008 showed much higher catch per unit effort in recent years regionally and in the South Atlantic Bight, which would likely not occur without a real and substantial increase in actual abundance (Arendt

et al. 2009). Whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence is not clear.

The NMFS Southeast Fishery Science Center has developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS SEFSC 2009). Model runs were done for each individual recovery unit as well as the western North Atlantic population as a whole, and the resulting trajectories were found to be very similar. One of the most robust results from the model was an estimate of the adult female population size for the western North Atlantic during 2004-2008. The distribution resulting from the model runs suggests the adult female population is estimated to be 20,000 to 40,000 individuals (NMFS SEFSC 2009). The model was also run using several scenarios in a predictive mode, and results projected an overall decline for the NWA DPS.

4.5.2 Designated Critical Habitat

As mentioned in section 4.5.1, designated critical habitat for the NWA DPS of loggerheads does occur in the action area. The critical habitat is categorized into 38 occupied marine areas and 685 miles of nesting beaches. Each marine area is important for at least one of the following reasons: nearshore reproduction, overwintering, breeding, migration, or *Sargassum* habitat. Because the proposed action would not affect beaches, the nesting beach critical habitat is not considered further in this biological opinion. Regarding the marine areas, the loggerhead critical habitat designated as LOGG-N-18 is in the action area and includes nearshore reproductive and constricted migratory habitats (79 FR 39856). The nearshore reproductive habitat was designated based on proximity to high-density nesting beaches, and such nearshore waters are frequently used by hatchlings and nesting females. In the vicinity of SLNPP, the nearshore reproductive critical habitat extends from the shoreline seaward about 1.6 km. Also in the vicinity of SLNPP, the constricted migratory critical habitat overlaps completely with the nearshore reproductive critical habitat and extends further seaward to about 24.5 km from the shoreline, which is at 200-m water depth. The constricted migratory habitat occurs off North Carolina and off Florida and provides a corridor between land and the Gulf Stream for migration between nesting, breeding, and foraging grounds; the corridor is highly used by juveniles and adults. Adults use the Florida corridor to migrate from foraging sites to breeding and nesting sites in March through May and vice versa in August through October, and juveniles and adults use the corridor to migrate south in the fall.

4.5.3 Distribution

Generally, loggerheads from the NWA DPS occur in pelagic and nearshore areas from northern South American to the northern United States. Most nesting for the NWA DPS occurs in southeastern U.S. and on the Yucatán Peninsula in Mexico, but nesting also occurs on coasts

from northern South America to parts of North America (NMFS and USFWS 2009). The largest subpopulation of the NWA DPS nests in southern Florida, which wholly includes the action area, but loggerheads foraging in the area could belong to one of a few different subpopulations within the NWA DPS (Witherington et al. 2006).

4.5.4 Reproduction and Life History

Loggerheads nest on ocean beaches and occasionally on estuarine shorelines in temperate and subtropic zones but not in the tropics (NMFS and USFWS 2009; Witherington et al. 2006). Typical nesting beaches are wide, sandy, backed by low dunes, and fronted by a flat, sandy approach (Conant et al. 2009). Florida nesting female loggerheads lay 4.1 nests every 2.7 years on average (Dodd 1988). The average clutch size at Melbourne Beach, Florida is 116 eggs (Witheringon 1986). Hatchling loggerheads migrate to the ocean, where they are generally believed to lead a pelagic existence for as long as 7-12 years (NMFS and USFWS 2008).

Loggerhead life history is characterized by development to a juvenile in the oceanic zone, which can last for over a decade, followed by recruitment to neritic zone where they become adults (NMFS 2013). The neritic zone provides foraging, inter-nesting, and migratory habitat for adults, and some may move between the neritic and oceanic zones. Loggerhead mating likely occurs along migration routes to nesting beaches, as well as in offshore from nesting beaches several weeks prior to the onset of nesting (Dodd 1988; Limpus and Limpus 2003). Loggerheads are a slow-growing species with sexual maturity as late as 37 years (NMFS 2013).

4.5.5 Diet

Hatchlings feed on macroplankton associated with *Sargassum* communities (NMFS and USFWS 2008; Witherington et al. 2006). Pelagic and benthic juveniles forage on crabs, mollusks, jellyfish, and vegetation usually at or near the surface (Dodd 1988; Wallace et al. 2009).

4.5.6 Migration

Loggerhead hatchlings migrate offshore and become associated with *Sargassum* habitats, driftlines, and other convergence zones (Carr 1986). After 14-32 years of age, loggerheads shift to a benthic habitat, where immature individuals forage in the open ocean and coastal areas along continental shelves, bays, lagoons, and estuaries (NMFS 2001b; Bowen et al. 2004). Some juveniles undergo lengthy migrations seasonally, and others remain in Florida waters. The migrating juveniles move north and shoreward during the spring, and they move south and offshore near the Gulf Stream during the fall (Witherington et al. 2006). Adults routinely migrate between foraging areas and nesting beaches with high fidelity.

4.5.7 Diving Behavior

Loggerhead diving behavior varies based upon habitat, with longer surface stays in deeper habitats than in coastal ones, and routine dives range from 4 to 172 min (Byles 1988; Renaud and

Carpenter 1994; Sakamoto et al. 1990). The maximum-recorded dive depth for a post-nesting female was over 230 m, although most dives are far shallower (9-21 m) (Sakamoto et al. 1990).

4.5.8 Threats

Similar to other sea turtle species, loggerheads experience threats from destruction, modification, and degradation of beach and pelagic habitats; poaching, killing, and predation; cold stunning; incidental takes in fisheries; and unquantified effects of climate change. Adverse effects to nesting habitat results from coastal development and construction, placement of erosion control structures, beachfront lighting, vehicular and pedestrian traffic, sand extraction, beach erosion, beach nourishment, beach pollution, removal of native vegetation, and planting of non-native vegetation (Mazaris et al. 2009). Marine habitats are altered by oil and gas exploration, marine pollution, underwater explosions, dredging, offshore artificial lighting, power plant entrapment and impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, trawl, purse seine, hook and line, gill net, pound net, longline, and trap fisheries.

Fisheries regulations significantly reduced loggerhead bycatch, particularly with implementation of the turtle excluder device in shrimp trawling fisheries. Offshore longline fisheries are also a serious concern for the survival and recovery of loggerhead sea turtles and appear to affect the largest individuals more than younger age classes (Aguilar et al. 1995; Howell et al. 2008; Tomás et al. 2008; Carruthers et al. 2009; Petersen et al. 2009).

Organochlorines detected in loggerhead tissue have the potential to suppress the immune system, affect metabolic regulation, and cause deficiencies in endocrine, developmental, and reproductive health (Keller et al. 2004; Storelli et al. 2007; Oros et al. 2009). Omnivory likely makes loggerheads prone to bioaccumulate toxins (Godley et al. 1999; Mckenzie et al. 1999). Heavy metals have also been found in tissues at levels that increase with turtle size (Godley et al. 1999; Saeki et al. 2000; Fujihara et al. 2003; Gardner et al. 2006; García-Fernandez et al. 2009).

Climate change may result in loss of nesting habitat from sea level rise. Also, incubation temperature determines sex of loggerhead embryos. Ambient temperature increase by just 1º-2º C can potentially change hatchling sex ratios to all or nearly all female in tropical and subtropical areas (Hawkes et al. 2007). The population in the action area, which includes an important nesting beach, is very female biased with a ratio of 9.5:1 (Witherington et al. 2006). Over time, genetic diversity or even population viability may be affected if males become a small proportion of populations (Hulin et al. 2009). Sea surface temperatures on loggerhead foraging grounds correlate to the timing of nesting, with higher temperatures leading to earlier nesting (Mazaris et al. 2009; Schofield et al. 2009). Increasing ocean temperatures may also lead to reduced primary productivity and eventual food availability, and warmer temperatures may also decrease the energy needs of a developing embryo (Reid et al. 2009).

4.6 U.S. DPS of Smalltooth Sawfish

The smalltooth sawfish is a tropical marine and estuarine, demersal elasmobranch. It has an extended snout with a long, narrow, flattened, rostral blade (rostrum) with a series of transverse teeth along either edge (Figure 9). In general, smalltooth sawfish inhabit shallow coastal waters of warm seas throughout the world.

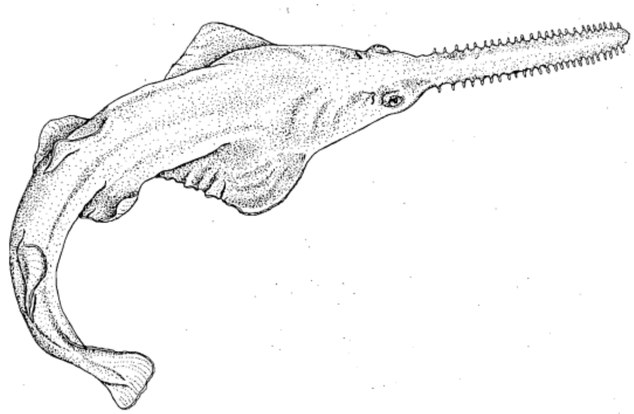


Figure 9. Smalltooth sawfish (*Pristis pectinata*).

Source: NMFS 2009.

4.6.1 Status and Trends

The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (68 FR 15674). Designated critical habitat for the U.S. DPS does not occur north of Florida Bay on the Atlantic coast of Florida and, therefore, is not near the action area addressed by this biological opinion. The IUCN listed the species "Critically Endangered" in 2006 because its global abundance declined at least 95 percent during the past three generations (i.e. since 1962), the species has likely been extirpated from large portions of its historic range, and the remaining populations are small and fragmented (Carlson et al. 2013).

Few long-term abundance data exist for the smalltooth sawfish, which makes it very difficult to estimate the current population size. Based on anecdotal data and the fact that the range has contracted by nearly 90%, with south and southwest Florida the only areas known to support a reproducing population, the U.S. population may number less than 5% of historic levels (Simpfendorfer 2001). Researchers have begun to compile capture and sightings data (collectively referred to as encounter data) in the International Sawfish Encounter Database (ISED) that was developed in 2000. Although these data cannot be used to assess the population

because of the opportunistic nature in which they are collected, researchers can use this database to assess the spatial and temporal distribution of smalltooth sawfish. We expect that as the population grows, the geographic range of encounters will also increase.

Despite the lack of scientific data on abundance, recent encounters with young-of-the-year, older juveniles, and sexually mature smalltooth sawfish indicate that the U.S. population is currently reproducing (Seitz and Poulakis 2002; Simpfendorfer 2003). The abundance of juveniles encountered, including very small individuals, suggests that the population remains viable (Simpfendorfer and Wiley 2004), and data analyzed from Everglades National Park as part of an established fisheries-dependent monitoring program (angler interviews) indicate a slightly increasing trend in abundance within the park over the past decade (Carlson et al. 2007; Carlson and Osborne 2012). An estimated intrinsic rate of natural population increase (e.g. rate of increase without density-dependent factors) for the species is 0.08-0.13 per year, and population doubling likely occurs every 5.4-8.5 years (Simpfendorfer 2000). The low intrinsic rate of population increase suggests that the species is particularly vulnerable to excessive mortality and rapid population declines, after which recovery may take decades.

4.6.2 Distribution

Although this species is reported to have a circumtropical distribution, NMFS identified smalltooth sawfish from the Southeast United States as a DPS, due to the physical isolation of this population from others, the differences in international management of the species, and the significance of the U.S. population in relation to the global range of the species (see 68 FR15674). Within the United States, smalltooth sawfish have been captured in estuarine and coastal waters from New York southward through Texas, although peninsular Florida has historically been the region of the United States with the largest number of recorded captures (NMFS 2000). Recent records indicate a resident reproducing population of smalltooth sawfish exists in south and southwest Florida from Charlotte Harbor through the Dry Tortugas, which is also the last U.S. stronghold for the species (Seitz and Poulakis 2002; Poulakis and Seitz 2004; Simpfendorfer and Wiley 2004). Water temperatures (no lower than 16-18°C) and the availability of appropriate coastal habitat (shallow, euryhaline waters and red mangroves) are the major environmental constraints limiting the northern movements of smalltooth sawfish in the western North Atlantic. Most specimens captured along the Atlantic coast north of Florida are large adults (over 10 ft in length) that likely represent seasonal migrants, wanderers, or colonizers from a historic Florida core population(s) to the south, rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953).

4.6.3 Reproduction and Life History

Smalltooth sawfish fertilization is internal and females give birth to live young. The brood size, gestation period, and frequency of reproduction are unknown for smalltooth sawfish. Therefore,

data from the closely related (in terms of size and body morphology) largetooth sawfish represent our best estimates of these parameters. The largetooth sawfish likely reproduces every other year, has a gestation period of approximately 5 months, and produces a mean of 7.3 offspring per brood, with a range of 1-13 offspring (Thorson 1976). Smalltooth sawfish are approximately 31 in (60 to 80 cm) at birth and may grow to a length of 18 ft (548 cm) or greater during their lifetime (Bigelow and Schroeder 1953; Simpfendorfer 2002; Simpfendorfer 2005). Juveniles grow rapidly for the first 2 years after birth; stretched total length increases by an average of 25-33 in (65-85 cm) in the first year and an average of 19-27 in (48-68 cm) in the second year (Simpfendorfer et al. 2008). By contrast, very little information exists on size classes other than juveniles, which make up the majority of sawfish encounters; therefore, much uncertainty remains in estimating life history parameters for smalltooth sawfish, especially as it relates to age at maturity and post-juvenile growth rates. The smalltooth sawfish is likely a slow-growing (with the exception of early juveniles), late-maturing (10-20 years) species with a long lifespan (30-60 years) (Thorson 1982; Simpfendorfer 2000). Juvenile growth rates suggest smalltooth sawfish are growing faster and, therefore, may reach sexual maturity at an earlier age than previously estimated (Simpfendorfer et al. 2008).

Each life history stage of the smalltooth sawfish has distinctly different habitat preferences. Juvenile smalltooth sawfish, those up to 3 years of age or approximately 8 ft in length (Simpfendorfer et al. 2008), inhabit the shallow waters of estuaries and can be found in sheltered bays, in dredged canals, along banks and sandbars, and in rivers (NMFS 2000). Juveniles occur in euryhaline waters (i.e. waters with a wide range of salinities) and are often closely associated with muddy or sandy substrates and with shorelines containing red mangroves (*Rhizophora mangle*) (Simpfendorfer 2001; Simpfendorfer 2003). Tracking data from the Caloosahatchee River in Florida indicate very shallow depths and salinity are important abiotic factors that influence juvenile smalltooth sawfish movement patterns, habitat use, and distribution (Simpfendorfer et al. 2011). Results from a recent acoustic tagging study in a developed region of Charlotte Harbor, Florida, showed that juveniles generally occur in shallow water within 328 ft (100 m) of mangrove (usually red mangroves) shorelines, which indicates importance of red mangroves near preferred juvenile habitat (Simpfendorfer et al. 2010). Juvenile smalltooth sawfish spend the majority of their time in waters less than 13 ft (4 m) in depth and are seldom found in depths greater than 32 ft (10 m) (Poulakis and Seitz 2004; Simpfendorfer et al. 2010). The smallest juveniles (young-of-the-year juveniles measuring < 100 cm in length) generally use water with depths less than 0.5 m (1.64 ft), had small home ranges (4,264-4,557 m^2), and exhibited high site fidelity (Simpfendorfer et al. 2010). Although small juveniles exhibit high site fidelity for specific nursery habitats for up to 3 months (Wiley and Simpfendorfer 2007), they do undergo small movements coinciding with changing tidal stages. These movements likely reduce the risk of predation and often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer 2006; Simpfendorfer et al. 2010). As

juveniles grow, they begin to expand their home ranges and eventually move to more offshore habitats where they likely feed on larger prey and eventually reach sexual maturity (Simpfendorfer et al. 2010; Simpfendorfer et al. 2011).

Researchers have identified several areas within the Charlotte Harbor Estuary that are disproportionately more important to juvenile smalltooth sawfish, based on intra- or inter-annual capture rates during random sampling events within the estuary (Poulakis et al. 2010; Poulakis et al. 2011). Use of such hotspot habitat areas can vary within and among years based on the amount and timing of freshwater inflow. Smalltooth sawfish use hotspots further upriver during high-salinity conditions (drought) and areas closer to the mouth of the Caloosahatchee River during times of high freshwater inflow (Poulakis et al. 2011). At this time, specific biotic or abiotic factors that influence this habitat use are unknown, but a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence habitat selection (Poulakis et al. 2011).

Adult smalltooth sawfish may also use the estuarine habitats used by juveniles, but they are commonly observed in deeper waters along the coasts. Nearly half of the encounters with adult-sized smalltooth sawfish in Florida Bay and the Florida Keys occurred in depths from 200-400 ft (70-122 m) of water (Poulakis and Seitz 2004). Similarly, adult encounters occurred in deep waters off the Florida Keys (Simpfendorfer and Wiley 2004), and observations from both commercial longline fishing vessels and fishery-independent sampling in the Florida Straits identified large smalltooth sawfish in depths up to 130 ft (~40 m) (ISED 2016). Even so, NMFS believes adult smalltooth sawfish use shallow estuarine habitats during parturition (when adult females return to shallow estuaries to pup) because very young juveniles still containing rostral sheaths are captured in these areas. Since very young juveniles have high site fidelities, we hypothesize that they are birthed nearby or in their nursery habitats.

4.6.4 Diet

Smalltooth sawfish feed on a variety of small fish (e.g., mullet, jacks, and ladyfish) and crustaceans (e.g., shrimp and crabs) (Bigelow and Schroeder 1953; Simpfendorfer 2001).

4.6.5 Threats

Smalltooth sawfish were once abundant along both coasts of Florida and quite common along the shores of Texas and the northern Gulf coast (NMFS 2010). Based on recent comparisons with historical reports, the U.S. DPS of smalltooth sawfish has declined over the past century (Simpfendorfer 2001; Simpfendorfer 2002). The decline in smalltooth sawfish abundance has been attributed to several factors including bycatch mortality in fisheries, habitat loss, and life history limitations of the species (NMFS 2010).

4.6.5.1 Bycatch Mortality

Bycatch mortality is the primary cause for the decline in smalltooth sawfish in the United States (NMFS 2010). While there has never been a large-scale directed fishery, smalltooth sawfish easily become entangled in fishing gears (gill nets, otter trawls, trammel nets, and seines) directed at other commercial species, often resulting in serious injury or death to the smalltooth sawfish (NMFS 2009). Such entanglements occurred in Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002), and Texas (Baughman 1943). One fisherman reported taking an estimated 300 smalltooth sawfish in one netting season in the Indian River Lagoon, Florida (Evermann and Bean 1897). In another example, smalltooth sawfish landings data gathered by Louisiana shrimp trawlers from 1945-1978, which contained both landings data and crude information on effort (number of vessels, vessel tonnage, number of gear units), indicated declines in smalltooth sawfish landings from a high of 34,900 lbs in 1949 to less than 1,500 lbs in most years after 1967. In 1995, Florida passed a net ban that led to a reduction in the number of smalltooth sawfish incidentally captured, "…by prohibiting the use of gill and other entangling nets in all Florida waters, and prohibiting the use of other nets larger than 500 square feet in mesh area in nearshore and inshore Florida waters"[1] (FLA. CONST. art. X, § 16). However, the threat of bycatch currently remains in commercial fisheries (e.g., South Atlantic shrimp fishery, Gulf of Mexico shrimp fishery, federal shark fisheries of the South Atlantic, and the Gulf of Mexico reef fish fishery), though anecdotal information collected by NMFS port agents suggests smalltooth sawfish captures are now rare.

In addition to incidental bycatch in commercial fisheries, smalltooth sawfish have historically been and continue to be captured by recreational fishermen. Encounter data (ISED 2016) and past research (Caldwell 1990) document that rostrums are sometimes removed from smalltooth sawfish caught by recreational fishermen, which greatly reduces the sawfish's survival likelihood. Given that possession of the species in Florida has been prohibited since 1992, the current threat of mortality associated with recreational fisheries is expected to be low, but recreational bycatch remains a potential threat to the species.

4.6.5.2 Habitat Loss

Modification and loss of smalltooth sawfish habitat, especially nursery habitat, is another contributing factor in the decline of the species. Activities such as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). Large areas of coastal habitat were modified or lost between the mid 1970s and mid 1980s within the United States (Dahl and

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[1] "nearshore and inshore Florida waters" means all Florida waters inside a line 3 mi seaward of the coastline along the Gulf of Mexico and inside a line 1 mi seaward of the coastline along the Atlantic Ocean.

Johnson 1991). Since then, rates of loss have decreased, but habitat loss continues. From 1998-2004, approximately 64,560 acres of coastal wetlands were lost along the Atlantic and Gulf coasts of the United States; approximately 2,450 of the lost acres were intertidal wetlands consisting of mangroves or other estuarine shrubs (Stedman and Dahl 2008). Further, over 703 mi of navigation channels and 9,844 mi of shoreline from 18 major southeastern estuaries were modified (Orlando et al. 1994). In Florida, coastal development often involves the removal of mangroves and the armoring of shorelines through seawall construction. Changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water-control devices have had other impacts: altered temperature, salinity, and nutrient regimes; reduced wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995). While these habitat modifications are not primary drivers of the decline of smalltooth sawfish abundance, they are likely contributing factors and almost certainly hamper the recovery of the species. Because juvenile smalltooth sawfish have an affinity for shallow estuaries, juveniles and their nursery habitats are particularly likely to be affected by these habitat losses or alternations. Although many forms of habitat modification are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue to threaten survival and recovery of the species in the future.

4.6.5.3 Life History Limitations

The smalltooth sawfish is also limited by its life history characteristics as a slow-growing, relatively late-maturing, and long-lived species. Animals using this life history strategy are usually successful in maintaining small, persistent population sizes in constant environments, but are particularly vulnerable to increases in mortality or rapid environmental change (NMFS 2000). The combined characteristics of this life history strategy result in a very low intrinsic rate of population increase that hinders recovery from any significant population decline (Simpfendorfer 2000). However, as mentioned in section 4.6.3, more recent data suggest smalltooth sawfish may mature earlier than previously thought, meaning rates of population increase could be higher and recovery times shorter than those currently reported (Simpfendorfer et al. 2008).

4.6.5.4 Additional Current Threats

Additional threats, such as the illegal commercial trade of smalltooth sawfish or their body parts, predation, and marine pollution and debris, may also affect the population and recovery of smalltooth sawfish on smaller scales (NMFS 2010). For example, sawfish rostra are popular curios, fins are used for shark-fin soup, and skin is used to make leather products (NMFS 2009). We anticipate that all of these threats will continue to affect the rate of recovery for the U.S. DPS of smalltooth sawfish.

In addition to the anthropogenic effects mentioned previously, changes to the global climate are likely to be a threat to smalltooth sawfish and their habitats. The Intergovernmental Panel on Climate Change stated that global climate change is unequivocal, and its impacts to coastal resources may be significant (IPCC 2007). Some likely impacts are sea level rise, increased frequency of severe weather events, changes in the amount and timing of precipitation, and changes in air and water temperatures (EPA 2015). Coastal habitats that contain red mangroves and shallow, euryhaline waters will be directly affected by climate change through sea level rise, which is expected to exceed 1 meter globally by 2100 (Meehl et al. 2007; Pfeffer et al. 2008; Vermeer and Rahmstorf 2009). Sea level rise will affect mangroves because sediment surface elevations for mangroves cannot keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). Sea level increases will also affect the amount of shallow water available for juvenile smalltooth sawfish nursery habitat, especially in areas where there is shoreline armoring (e.g., seawalls). Further, the changes in precipitation coupled with sea level rise may also alter salinities of coastal habitats, reducing the amount of available smalltooth sawfish nursery habitat. Such ongoing threats from climate change will slow recovery and may contribute to further population declines for the smalltooth sawfish.

5 ENVIRONMENTAL BASELINE

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 (50 CFR 402.02).

5.1 SLNPP Continued Operation

The only action that has undergone a section 7 consultation by NRC is continued operation of SLNPP. NMFS produced biological opinions for the ongoing operations at the SLNPP in 1977 and 2001. Unit 1 of the SNLPP became operational in 1976, and Unit 2 became operational in 1983. The ongoing sea turtle capture-and-release program at SLNPP is described in section 5.6. Over 16,600 sea turtles have been captured at SLNPP as of February 2016, and 297 of the captured sea turtles died (FPL and IRG 2015a, 2015b; NRC 2016; FPL 2016). Through February 2016, the species composition of the sea turtles captured are: 9552 loggerheads (including 180 mortalities), 6886 green (including 112 mortalities), 42 leatherback (no mortalities), 67 Kemp's ridley (including 4 mortalities), and 65 hawksbill sea turtles (including 1 mortality). Only since 2001 have the mortalities been classified as causally (or non-causally) related to operation of SLNPP, and not all mortalities were causal to SLNPP operations: 59 percent of dead loggerheads were causal to SLNPP operation, 46 percent of greens, and none of hawksbills (no leatherback or Kemp's ridley mortalities occurred since 2001).

Smalltooth sawfish are occasionally encountered in the Atlantic Ocean. Adult smalltooth sawfish are mobile and may move in and out of the action area. Smalltooth sawfish encounter data from May 2010 to May 2011 contain 14 smalltooth sawfish encounters in St. Lucie County, Florida (ISED 2016). Only one smalltooth sawfish capture has occurred at SLNPP (May 16, 2005); the animal was rescued with minor scrapes and returned to the Atlantic Ocean in good condition. No specific preferential use of the action area is known for the species; however, since individuals may be found in the action area, activities described in this section could potentially affect smalltooth sawfish.

5.2 Vessel Traffic

Commercial traffic and recreational pursuits can have an adverse effect on sea turtles through propeller and boat strike damage. Vessel traffic is ongoing in the Atlantic Ocean adjacent to the SLNPP and sea turtles have been captured at the SLNPP with boat strike injuries on their carapaces. No vessel traffic impacts on sawfish have been documented from the action area.

5.3 Recreational Fisheries

No commercial fisheries occur in the nearshore, hardbottom habitat areas that comprise the action area. However, recreational fishing from private vessels and from shore does occur in the area. Observations of state recreational fisheries have shown that loggerhead, leatherback, and green sea turtles are known to bite baited hooks, and loggerheads frequently ingest the hooks. Hooked turtles have been reported by the public fishing from boats, piers, beaches, banks, and jetties (NMFS 2001b). Additionally, lost or derelict fishing gear can also pose an entanglement threat to sea turtles and/or smalltooth sawfish in the area. A detailed summary of the known impacts of hook-and-line incidental captures to loggerhead sea turtles can be found in the TEWG reports (1998; 2000; 2009). Smalltooth sawfish are incidentally captured by fishermen, but no incidental captures have been documented in the action area.

5.4 In-water Research Projects

In Florida, in-water sea turtle research has increased in recent years, but no coordinated trend-monitoring program exists for in-water populations. Most in-water projects are, or were, located on the southeast coast of Florida. In addition to dedicated in-water studies, other projects and activities were identified that involve the collection of sea turtle data, often secondary to the primary purpose, that help identify target areas for future in-depth studies. Other data come from incidental capture in fisheries research projects, or by the fisheries themselves. Pre-dredge trawling, sea turtle aerial surveys, stranding networks, and satellite tracking of sea turtles also provide important distributional data.

No dedicated in-water research projects are ongoing in the project area for smalltooth sawfish. Outreach efforts are ongoing throughout Florida to obtain encounter reports of smalltooth sawfish captured by commercial and recreational fishers, or any animals sighted by the public.

5.5 Other Potential Sources of Impacts in the Environmental Baseline

Pollutants, including anthropogenic marine debris and noise, may indirectly affect listed species in the action area. Such impacts are difficult to measure, and conservation actions focus on monitoring and studying impacts from these sources.

Sources of pollutants along the Atlantic coastal regions include atmospheric loading of pollutants such as polychlorinated biphenyl compounds (PCBs), stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean, and groundwater and other discharges. Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986), the impacts of many other anthropogenic toxins have not been investigated. Smalltooth sawfish have been encountered with polyvinyl pipes and fishing gear on their rostrum.

5.6 Conservation and Recovery Actions Shaping the Environmental Baseline

The SLNPP is located on Hutchinson Island on the east coast of Florida where green, loggerhead, and occasionally leatherback sea turtles nest. As required by Terms and Conditions of the 2001 biological opinion for the SLNPP, FPL biologists have led public turtle education walks on the beach and also participated in sea turtle nesting surveys on Hutchinson Island. However, nest surveys have been conducted on the island since the early 1970s. Loggerhead nesting patterns showed an increasing trend until a peak in 2000 followed by a decreasing trend until about 2006; the past decade had an increasing trend but the number of nests has not reached the 2000 peak number. Green sea turtle nests have waxed and waned in an overall increasing trend; however, a sharp decline in the number of nests occurred from 2013 to 2014. Leatherback nests were few on the island until about the late 1990s when numbers began an increasing trend. The 2014 sea turtle nesting survey on Hutchinson Island results were 7027 loggerhead, 221 green, and 352 leatherback sea turtle nests for the year (FPL and IRG 2015a).

No specific in-water sea turtle research work is ongoing in the project area, but in-water sea turtle research has been conducted in nearby areas. NMFS and cooperating states have established an extensive network of STSSN participants along the Atlantic and Gulf of Mexico coasts that collect data on dead sea turtles and rescue and rehabilitate live stranded sea turtles. Some STSSN activities and other research activities are conducted on turtles rescued from the SLNPP intake canal, and those activities are permitted by the state and USFWS.

Regulations restricting the use of gear known to incidentally catch smalltooth sawfish may benefit the species by reducing their incidental capture and/or mortality in these gear types. In 1994, entangling nets (including gillnets, trammel nets, and purse seines) were banned in Florida state waters. Although intended to restore the populations of inshore gamefish, this action removed possibly the greatest source of fishing mortality on smalltooth sawfish (Simpfendorfer 2002).

Public outreach efforts help educate the public on smalltooth sawfish status and proper handling techniques and help to minimize interaction, injury, and mortality of encountered smalltooth sawfish. Information regarding the status of smalltooth sawfish and what the public can do to help the species is available on the websites for Florida Museum of Natural History[2] and NMFS.[3]

Research, monitoring, and outreach efforts on smalltooth sawfish are providing valuable information on which to base effective conservation management measures. Monitoring and research programs for the smalltooth sawfish are ongoing in southwest Florida. Surveys are conducted using longlines, setlines, gillnets, rod and reel, and seine nets. Cooperating fishermen, guides, and researchers also report smalltooth sawfish encounters. Data collected are providing new insight on the species's current distribution, abundance, and habitat use patterns. The Florida Museum of Natural History manages the International Sawfish Encounter Database[4], which provides valuable data for recovery of the U.S. population of smalltooth sawfish.

The Fish and Wildlife Research Institute (formerly Florida Marine Research Institute) is responsible for collecting a wide variety of estuarine and marine fisheries data for the State of Florida (e.g., stock assessments, life history, fisheries-dependent monitoring, and fisheries-independent monitoring). The fisheries sampling conducted statewide by the State of Florida has the potential to provide a significant amount of data on smalltooth sawfish, especially as recovery of the species progresses and sawfish move beyond their current south Florida range.

The FWC's Fisheries-Independent Monitoring Program was initiated in 1989 and is an ongoing, long-term sampling program that monitors the relative abundance of fishery resources in Florida's major estuarine, coastal, and reef systems. The FWC's Fisheries-Dependent Monitoring Program, in cooperation with NMFS, collects and compiles data on recreational landings, commercial landings, and processed fishery products in Florida.

6 Effects of the Action on Species and Critical Habitat

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or

[2] http://www.flmnh.ufl.edu/fish/Sharks/Sawfish/SRT/srt.htm
[3] http://www.sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm
[4] http://www.flmnh.ufl.edu/fish/sharks/sawfish/sawfishdatabase.html

interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

6.1 Potential Effects Associated with the Proposed Action

Continued operation of SLNPP, as described in section 2.1, includes several components with potential to affect ESA-listed species. The possible impacts are described below according to attributable component of SLNPP.

Based on capture records provided by FPL recorded between the issuance of the last biological opinion (2001) through February 2016, approximately 16,619 sea turtles have been captured during the continued operation of the plant. All five species of sea turtles have been captured by the plant. Over half of the takes are loggerheads, slightly less than half of the takes are greens, and leatherback, hawksbill, and Kemp's ridley takes combined represent less than one percent of the takes. Since February 2016, only 297 of the captures (1.8 percent) resulted in mortality.

The only smalltooth sawfish take at SLNPP occurred on May 16, 2005, and the animal was released alive.

6.1.1 Travel through Intake Pipeline

When an animal enters the intake pipeline just below the offshore velocity cap while SLNPP is operating, the flow rate is likely too high for the animal to escape by swimming back toward the velocity cap. Because fouling organisms or limited debris occasionally occupy the inside of the pipes, animals traveling through the pipes may be injured.

6.1.1.1 Intake Pipeline Effects on Sea Turtles

Injuries to sea turtles related to intake-pipe entrainment and travel through the pipe into the intake canal occur occasionally. No known instances of turtle mortalities have occurred from forced submergence in the intake pipes, and no known entrainment of hatchlings in the intake pipes has occurred. When both operating units are running simultaneously, the approximate transit time through the intake pipes is less than 5 minutes, which is too short to drown a sea turtle. Sea turtles may receive scrapes, cuts, or skull fractures while traveling in the intake pipe. Periodic cleaning of the debris and fouling organisms inside the intake pipe minimizes injuries. Sea turtles that are captured and in need of rehabilitation are taken to facilities that are associated with the STSSN. Rehabilitation facilities within the STSSN are staffed with marine biologist and veterinarians that assess the status and cause of injury or death for sea turtles captured at the SLNPP. Necropsies must be performed by a qualified veterinarian on dead sea turtles found in fresh condition.

6.1.1.2 Intake Pipeline Effects on Smalltooth Sawfish

Similar to sea turtles, smalltooth sawfish may receive scrapes or cuts while traveling in the intake pipe. Periodic cleaning of the debris and fouling organisms inside the intake pipe minimizes injuries. However, minor and moderate injuries may occur.

6.1.2 Entrapment in the Intake Canal

Once an animal exits the intake pipeline into the intake canal, the animal is entrapped in the intake canal. The FPL's ongoing rescue program allows capture of the animal to facilitate its return to the natural environment. However, the rescue program requires use of nets, which may induce stress if an animal becomes entangled in a net.

6.1.2.1 Effects of Entrapment, Capture, and Release on Sea Turtles in the Intake Canal

Biologists capture most sea turtles in the intake canal alive. Sea turtle handling time, including tagging and data collection, is limited to 30 minutes when possible to minimize stress. Sea turtles entrapped in the intake canal would die over time without the capture-and-release program.

Before rescue, sea turtles in the intake canal could become tangled in one of the nets described in section 2.1.1.3. Entanglement could result in drowning, stress, or injury. The last reported drowning in a tangle net was in 1999. The primary capture method is by hand or dip net before they encounter a tangle net, which eliminates drowning and minimizes stress and injury. Small cuts or scratches could occur during capture and rescue from the nets and other handling. The FPL estimates the average residency time for turtles in the intake canal to be less than three days. Marine biologists monitor the intake canal seven days a week for 8 hours a day under normal conditions. Marine biologists monitor the intake canal for 4 hours a day on holidays. If a leatherback turtle, adult sea turtle (during nesting season only), or a sick or injured turtle is identified in the canal, marine biologists work 7 days a week for 12 hours a day. Additionally, if algae, jellyfish, or cold-stunning events occur, biologists extend their monitoring hours and also place divers in the water to monitor the integrity of the 5-in-mesh barrier net. During monitoring periods, tangle nets are inspected hourly from a boat, and entangled turtles are rescued and released to the ocean or reported as sick or injured to receive proper attention.

Turtles rarely make it past the 5-in and 8-in barrier nets, but directed capture is required if a turtle is observed west of the 8-in net. The Underwater Instrusion Detection System net has a downward slope in the direction of the current that increases threat of injury or drowning of sea turtles, but only one mortality at the Underwater Instrusion Detection System net has been documented since 1990. Overall, some sea turtles may be injured or killed during capture in the nets in the intake canal.

Routine dredging maintenance in the canal could affect sea turtles. Although NMFS determined that non-hopper dredging would not likely adversely affect sea turtles, that determination does

not apply in confined spaces such as the SLNPP intake canal. During 1976-1990, 7 loggerhead turtles were taken in the intake canal during maintenance dredging. In 1994, maintenance dredging was completed by isolating the dredge area with a temporary 4-in net, and no sea turtles were taken. Since issuance of the 2001 biological opinion, FPL implemented harm avoidance measures identified as terms and conditions and described in section 2.1.1.3, and no sea turtles have been injured during maintenance dredging. Therefore, maintenance dredging is not likely to adversely affect sea turtles. Based on these measures being used during dredging, we expect the effects from maintenance dredging will be discountable.

6.1.2.2 Effects of Entrapment, Capture, and Release on Smalltooth Sawfish in the Intake Canal

Biologists would rescue any smalltooth sawfish in the intake canal and return it to the ocean. Entanglement could stress the animal, and rescue efforts would begin immediately using proper techniques to prevent injury. Biologists that monitor the SLNPP intake canal underwent sawfish handling training at Mote Marine Laboratory in 2006 after a smalltooth sawfish was rescued from the intake canal. The FPL and NMFS created "Smalltooth Sawfish (*Pristis pectinata*) Handling, Transportation, and Release Protocols" that were adopted for use in 2007 to minimize effects on any captured smalltooth sawfish (FPL 2007). A sawfish may be injured or killed if it encounters a tangle or barrier net in the intake canal without being detected by biologists. However, smalltooth sawfish in the action area are expected to be large (>4 m long) subadults or adults; therefore, observation of such individuals is expected. Based on the successful capture and release of the only sawfish discovered in the SLNPP intake canal, NMFS expects that any sawfish in the canal could be captured and released alive.

Effects of maintenance dredging on smalltooth sawfish in the intake canal would be discountable based on adherence to harm avoidance measures described in section 2.1.1.3. Such measures would protect smalltooth sawfish just as they would turtles; therefore, dredging effects on smalltooth sawfish would be insignificant.

6.1.3 Effects of Intake Structure on Sea Turtles and Smalltooth Sawfish

If a sea turtle or smalltooth sawfish moves past the tangle nets and three barrier nets in the intake canal, the animal could be injured or killed at the intake wells. Screens at the intake wells are inspected visually 4 times per every 24 hours. Since 1990, two documented events occurred in which sea turtles reached the intake wells. In 2006, 24 loggerhead hatchlings traveled through all nets and reached the intake wells. At the intake screens, 21 dead hatchlings were found, and 3 hatchlings were sent to a rehabilitation facility. The event occurred as a result of a female who nested on the bank of the intake canal. Such nesting activity is not expected to recur because a shoreline hardening project was completed in 2009, which removed suitable nesting substrate from the canal banks. In 2015, a small juvenile green turtle was removed from the intake and

sent to a rehabilitation facility for recovery from injuries caused by entanglement in fishing line. As a result of the incident, FPL divers inspected and repaired the 5-in barrier net that the green turtle passed through to reach the intake wells.

Given the large size of smalltooth sawfish at birth (80 cm), they would only reach the intake wells if all nets have holes, which is highly unlikely. Because of the shoreline hardening and the inspection of barrier nets, effects on sea turtles and smalltooth sawfish are discountable.

6.1.4 Effects of Discharge Systems on Sea Turtles and Smalltooth Sawfish

The thermal plume caused by the SLNPP discharges of heated water is limited by the Florida Department of Environmental Protection. During normal operations, the temperature of discharge waters cannot exceed a maximum 115 °F or rise more than 30 °F above the ambient water temperature, the discharge waters cannot cause the ocean surface water temperature to exceed 97 °F as an instantaneous maximum, and the total area of the mixing zone may not exceed 511,804 ft^2 in the Atlantic Ocean. Sea turtles and smalltooth sawfish may feed or swim near the mixing zone, but they may avoid the small mixing zone. Such avoidance behavior is not expected to affect sea turtles or smalltooth sawfish, and therefore, the effects of the discharge systems would be insignificant.

Cooling water discharge from SLNPP would enter the loggerhead NWA DPS critical habitat, but the effects would be insignificant because the size of the mixing zone is negligible relative to the size of the designated critical habitat.

6.1.5 Effects of Taprogge Condenser Cleaning System on Sea Turtles and Smalltooth Sawfish

The released sponge balls could harm sea turtles or smalltooth sawfish if ingested. Sea turtles are known to ingest marine debris, but none of the necropsied turtles from SLNPP have had any sponge balls in gut content. Because smalltooth sawfish are demersal and feed on benthic organisms, they are unlikely to ingest the floating sponge balls. Sponge ball releases have discountable effects to sea turtles and smalltooth sawfish in the action area, but because the balls are not recovered from the beach, they are likely contributing to the global problem of marine debris.

6.2 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 CFR 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.

Current activities in the action area, such as recreational boating and fishing, are expected to continue at present levels of intensity. Anticipated effects on sea turtles and smalltooth sawfish include incidental capture by fishermen, vessel strikes, interaction with marine debris, chemical discharges, and anthropogenic noise. If boating and fishing activities increase, possible effects may increase as well.

Some shore-based activities may affect sea turtle nesting habitat and related behaviors. For example, beachfront development, lighting, and erosion control could degrade sea turtle nesting habitat or hinder hatchlings from crawling to the ocean after emerging from nests. Conservation efforts, including FPL's turtle walks, are reducing potential effects to sea turtle nesting habitat, nesting turtles, eggs, and hatchlings.

6.3 Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 6.1) to the environmental baseline (Section 5) and the cumulative effects (Section 6.2) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) reduce the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4).

6.3.1 Effects of the Proposed Action on Likelihood of Sea Turtle Survival and Recovery

This section presents the analysis regarding the likelihood of lethal or non-lethal takes to reduce distribution, reproduction, or numbers of green, hawksbill, Kemp's ridley, leatherback, or loggerhead (NWA DPS) sea turtles. Next, a determination is made regarding whether such reductions are likely to reduce appreciably the survival and recovery of each species. Particular attention is paid to population effects of incidental takes on reproductively mature individuals.

6.3.1.1 Survival and Recovery of Green Sea Turtles

The proposed action may non-lethally capture up to 500 green turtles annually until March 1, 2036, which is the license expiration date for SLNPP Unit 1. Approximately 7 green turtles captured could be non-lethally, severely injured by ongoing plant operations annually until March 1, 2036. All turtles that have sustained injuries (e.g., scrapes) requiring treatment would be sent to a rehabilitation facility after consultation with FWC. The effects of these non-lethal captures and injuries are not expected to have any measurable impact on the reproduction, numbers, or distribution of green sea turtles because the animals are released back into the wild within approximately 1-4 days from capture. The individuals are expected to fully recover such

that no reductions in reproduction or numbers of green sea turtles are anticipated. Since the animals are returned back to the area where they were captured, no change in the distribution of green sea turtles is anticipated.

Up to 5 green turtles may be killed by plant operations annually until March 1, 2036. These causal, lethal takes will reduce the number of green sea turtles compared to their numbers in the absence of the proposed action. Lethal takes could also result in a potential reduction in future reproduction, assuming the individuals were females and would have survived to reproduce. For example, an adult green sea turtle can lay 1-7 clutches (usually 2-3) every 2 to 4 years, with 110-115 eggs/nest. The loss of 5 adult female sea turtles per year until 2036 could preclude the production of potentially thousands of eggs and hatchlings, of which a fractional percentage are expected to survive to sexual maturity. The overall percent of hatchling sea turtles that reach sexual maturity has been generally estimated (without regard to species) by the sea turtle scientific community as ranging from 0.002 percent (1 in 500 hatchlings) to 0.001 percent (1 in 1,000 hatchlings). The attainment of sexual maturity in green sea turtles has been estimated at between 20 and 50 years.

Whether the reductions in numbers and reproduction of these species attributed to the continued operation of the SLNPP would appreciably reduce their likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. The recent status review for green sea turtles states that all major nesting populations in the North Atlantic are stable or increasing (Seminoff et al. 2015). More specifically, in Florida the pattern of green sea turtle nesting shows biennial peaks in abundance, with a generally increasing trend during the regular monitoring since establishment of index beaches in Florida in 1989. Although the anticipated mortalities would result in an instantaneous reduction in absolute population numbers, the U.S. populations of green sea turtles would not be appreciably affected. For a population to remain stable, sea turtles must replace themselves through successful reproduction at least once over the course of their reproductive lives, and at least one offspring must survive to reproduce itself. If the hatchling survival rate to maturity is greater than the mortality rate of the population, the loss of breeding individuals would be replaced through recruitment of new breeding individuals from successful reproduction of non-taken sea turtles. The population abundance trend information for green sea turtles appears to show that they are either stable or increasing. The loss of a small number (annually from the date of this biological opinion to March 1, 2036) of green turtles, even if they were reproductive females, would not have any measurable effect on that trend.

Although no change in distribution is expected for green sea turtles, lethal takes would result in a reduction in absolute population numbers that may also reduce reproduction, but these reductions are not expected to appreciably reduce the likelihood of survival of green sea turtles in the wild. Based on the above analysis, we believe the proposed action is not reasonably expected to cause,

directly or indirectly, an appreciable reduction in the likelihood of survival of the green sea turtle in the wild.

The following analysis considers the effects of the anticipated take on the likelihood of recovery in the wild. The Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) includes recovery objectives over a period of 25 continuous years to be an average increase of 6,000 nests per year in Florida and also a reduction in stage class mortality based on an increase in abundance of individuals in foraging grounds. Nesting in Florida has increased significantly with an annual average increase of over 7,000 nests since 2001 (Seminoff et al. 2015). Currently no estimates are available to specifically address changes in abundance of individuals on foraging grounds.

The potential non-lethal capture of up to 500 green sea turtles per year (including up to 7 severely injured green turtles) and the lethal take of up to 5 green turtles per year from the date of this biological opinion until March 1, 2036, are not likely to reduce population numbers over time due to current population sizes and expected recruitment. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action is not in opposition to the recovery objectives above and would not result in an appreciable reduction in the likelihood of green sea turtle's recovery in the wild.

6.3.1.2 Survival and Recovery of Hawksbill, Kemp's Ridley, and Leatherback Sea Turtles

The proposed action may result in the non-lethal capture of up to 7 hawksbill, 8 Kemp's ridley, and 5 leatherback sea turtles annually from the date this biological opinion is issued until March 1, 2036. These non-lethal takes are not expected to have any measurable impact on the reproduction, numbers, or distribution of these species. The captured sea turtles would be returned to the wild and are expected to fully recover such that no reductions in reproduction or numbers of these species are anticipated. Since sea turtles taken in the SLNPP are returned to the wild in the general area where caught (on average, within four days of capture), no change in the distribution of hawksbill, Kemp's ridley, or leatherback sea turtles is anticipated. No lethal or severely injurious takes of any of these species has resulted from SLNPP operations from 2001-2014. However, injury or death from SLNPP operations is possible, albeit unlikely. One lethal or non-lethal, severely injurious take of the combined three species (hawksbill, Kemp's ridley, or leatherback sea turtles) is expected every two years from the continued operation of the SLNPP. One lethal or severely injurious take every two years for these combined species is not likely to reduce population numbers over time. As stated in section 6.3.1.1, all turtles that have sustained injuries (e.g., scrapes) requiring treatment would be sent to a rehabilitation facility after consultation with FWC. The effects of non-lethal capture, handling, and release of these species are not expected to injure them. Thus, the proposed action is not in opposition to the recovery

objectives above and would not result in an appreciable reduction in the likelihood of hawksbill, Kemp's ridley, and leatherback sea turtles' recoveries in the wild.

6.3.1.3 Survival and Recovery of NWA DPS of Loggerhead Sea Turtles

The proposed action may result in annual maximum non-lethal capture (take) of up to 623 NWA DPS loggerhead sea turtles annually until March 1, 2036. SLNPP opertions would likely kill 3 loggerhead sea turtles annually until March 1, 2036. Approximately 3 loggerhead sea turtles captured could be non-lethally, severely injured by ongoing plant operations annually until March 1, 2036. As stated in section 6.3.1.1, all turtles that have sustained injuries (e.g., scrapes) requiring treatment would be sent to a rehabilitation facility after consultation with FWC.

The potential non-lethal take of 623 loggerhead sea turtles (including 3 severe causal injuries) annually until March 1, 2036, is not expected to have any measurable impact on the reproduction, numbers, or distribution of this species. These individuals are expected to fully recover such that no reductions in reproduction or numbers of loggerhead sea turtles are anticipated. Since these animals would be returned to the area where they were taken, within approximately 1 to 4 days of capture, no change in the distribution of loggerhead sea turtles is anticipated.

The potential lethal take of 3 loggerheads per year until March 1, 2036, would reduce the number of loggerheads as compared to their numbers in the absence of the proposed action. Lethal takes could also result in a potential reduction in future reproduction, assuming these individuals were female and would have survived to reproduce. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs with 100-130 eggs/clutch every 2 to 4 years. The loss of three adult female sea turtles per year could preclude the production of potentially thousands of eggs and hatchlings, of which a fractional percentage are expected to survive to sexual maturity. The attainment of sexual maturity in loggerhead sea turtles has been estimated at between 20 and 38 years. The overall percentage of hatchling sea turtles that reach sexual maturity has been generally estimated (without regard to species) by the sea turtle scientific community as ranging from 0.002 percent (1 in 500 hatchlings) to 0.001 percent (1 in 1,000 hatchlings).

Considering the size of the NWA DPS of loggerheads, the loggerhead sea turtle population is sufficiently large to persist and recruit new individuals to replace those expected to be lethally taken (i.e., three lethal loggerhead takes annually). The most current nesting trends for the NWA DPS, from 1989-2010, indicates the nesting trend is slightly negative, but the rate of decline is not statistically different from zero. Additionally, the range from the statistical analysis of the nesting trend includes both positive and negative growth as demonstrated by (FWC 2015).

Five recovery units or nesting subpopulations are identified in the Northwest Atlantic Ocean (now designated as the NWA DPS): Northern (Florida/Georgia boarder to South Virginia), Peninsular Florida (Florida/Georgia border south through Pinellas County, Florida, excluding the

islands west of Key West), Northern Gulf of Mexico (NGMRU), Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU) (NMFS and USFWS 2009). The Peninsular Florida Unit represents approximately 87% of all nesting efforts in the NWA DPS (Ehrhart et al. 2003). A significant (26%) declining trend was documented in the Peninsular Florida Unit based on nesting data from 1989 through 2008 (NMFS and USFWS 2009). Additional data through 2010 changed the nesting trend for the Peninsular Florida Unit so that it does not show a nesting decline statistically different from zero (76 FR 58868).

The loss of up to three individuals annually, even if they are removed from the smallest recovery unit, would not have a measurable impact on the likelihood of the loggerhead's survival in the wild. Although the declining annual nest density at major loggerhead sea turtle nesting beaches requires further study and analysis to determine the causes and long-term effects on population dynamics, the likelihood of survival in the wild of the NWA DPS of loggerheads would not be appreciably reduced because of this action. Therefore, until March 1, 2036, the annual non-lethal take of up to 623 loggerheads (including 3 severe causal injuries) and the annual lethal take of 3 loggerhead sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of survival of this species in the wild.

The second revision of the recovery plan for the Northwest Atlantic population of loggerhead sea turtles (NMFS and USFWS 2009), herein incorporated by reference, lists the following relevant recovery objectives:

- 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
  - <u>Northern Recovery Unit</u>

    (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 2 percent or greater resulting in a total annual number of nests of 14,000 or greater for this recovery unit (approximate distribution of nests is NC=14 percent [2,000], SC=66 percent [9,200], and GA=20 percent [2,800]).

    (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).
  - <u>Peninsular Florida Recovery Unit</u>

    (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is statistically detectable (1 percent), resulting in a total annual number of nests of 106,100 or greater for this recovery unit.

(2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Dry Tortugas Recovery Unit

  (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 3 percent or greater, resulting in a total annual number of nests of 1,100 or greater for this recovery unit.

  (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Northern Gulf of Mexico Recovery Unit

  (1) There is statistical confidence (95 percent) that the annual rate of increase over a generation time of 50 years is 3 percent or greater resulting in a total annual number of nests of 4,000 or greater for this recovery unit (approximate distribution of nests (2002-2007) is FL=92 percent [3,700] and AL=8 percent [300]).

  (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

- Greater Caribbean Recovery Unit

  (1) The total annual number of nests at a minimum of three nesting assemblages, averaging greater than 100 nests annually (e.g., Yucatán, Mexico; Cay Sal Bank, the Bahamas) has increased over a generation time of 50 years.

  (2) This increase in number of nests must be a result of corresponding increases in number of nesting females (estimated from nests, clutch frequency, and remigration interval).

• 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.

  - Trends in Abundance on Foraging Grounds:

    A network of in-water sites, both oceanic and neritic, distributed across the foraging range is established and monitoring is implemented to measure abundance. There is statistical confidence (95 percent) that a composite estimate of relative abundance from these sites is increasing for at least one generation.

- Trends in Neritic Strandings Relative to In-water Abundance:

  Stranding trends are not increasing at a rate greater than the trends in in-water relative abundance for similar age classes for at least one generation.

The potential non-lethal annual take of up to 623 (including 3 severe causal injuries) until March 1, 2036, and up to 3 lethal annual takes until March 1, 2036, of NWA DPS loggerhead sea turtles would result in a reduction in numbers when lethal takes occur but is unlikely to have any detectable influence on the current trends. Non-lethal takes of sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action is not in opposition to the recovery objectives above and is not likely to result in an appreciable reduction in the likelihood of NWA DPS loggerhead sea turtle recovery in the wild.

6.3.2 Effects of the Proposed Action on Likelihood of Survival and Recovery of U.S. DPS of Smalltooth Sawfish

The proposed action may result in one non-lethal capture (take) of U.S. DPS smalltooth sawfish every five years until March 1, 2036. The anticipated non-lethal take (with or without causal injury) of one smalltooth sawfish every five years would not appreciably reduce the species's likelihood of survival and recovery in the wild.

No reduction in numbers is expected as the take would be non-lethal. Likewise, no reduction in reproduction would occur as only one individual is expected to be affected. Based on the use of the safe handling and release protocols and lack of lethal take, the reproductive output of the individual would not be affected.

Smalltooth sawfish occur in a limited distribution range as described previously, and the SLNPP action area occurs outside of the current core range. However, the number of reported sawfish encounters in the general area of SLNPP has increased since 2005 when the take occurred (ISED 2016). The anticipated non-lethal take of one sawfish every five years by the SLNPP would not result in the removal of the captured individuals from the general area because the animal would be returned to the ocean. Therefore, the anticipated impacts would not affect the species's distribution.

In summary, no reduction in numbers, reproduction, or distribution would result from the non-lethal take of one smalltooth sawfish every five years, and the take is not expected to measurably affect the species's status or trends. Therefore the anticipated impacts are not expected to appreciably reduce the species' likelihood of survival in the wild.

The predicted impact to smalltooth sawfish relates to several recovery plan objectives (NMFS 2009):

1. Minimize human interactions and associated injury and mortality;

2. Protect and/or restore smalltooth sawfish habitats; and,
3. Ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had been previously extirpated.

The project is expected to have, at most, a minimal degree of human interaction with smalltooth sawfish. As mentioned earlier, non-lethal take of one smalltooth sawfish every five years into the SLNPP is expected. The impact of this interaction would be minimized through the requirement for SLNPP biologists to comply with the Smalltooth Sawfish Handling, Transportation, and Release Protocols. No impacts to sawfish habitat or to sawfish abundance are expected from the proposed action. Therefore, the proposed action is not likely to interfere with the attainment of the recovery objectives. Thus, the effects of the proposed action would not cause an appreciable reduction in the likelihood of recovery of the U.S. DPS of smalltooth sawfish in the wild.

6.3.3 Effects of the Proposed Action on Designated Critical Habitat

This section presents the determination regarding whether the proposed action would reduce the value of designated or proposed critical habitat for conservation of the species. The only designated or proposed critical habitat in the action area is the designated critical habitat for the NWA DPS of loggerhead sea turtles. As discussed in section 4.5.2, the critical habitat includes nearshore reproductive and constricted migratory habitats. The intake and discharge pipelines have tiny structural footprints that do not affect the critical habitat for reproduction or migration uses by the loggerhead NWA DPS. Likewise, as described in section 6.1.4, the thermal plume affects only a very small area, which is a negligible, statistically insignificant amount of the critical habitat. Continued operation of SLNPP would not result in any changes to the area and would not alter any physical or biological features of or reduce conservation value of the critical habitat. Therefore, the proposed action would not destroy or adversely modify designated critical habitat for the loggerhead NWA DPS.

7 CONCLUSION

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, any effects of interrelated and interdependent actions, and cumulative effects, NMFS’s biological opinion is that the proposed action is not likely to jeopardize the continued existence of green sea turtle, hawksbill sea turtle, Kemp’s ridley sea turtle, leatherback sea turtle, NWA DPS of loggerhead sea turtle, or U.S. DPS of smalltooth sawfish or to destroy or adversely modify the designated critical habitat of the loggerhead NWA DPS.

8 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to ESA-listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Sections 7(b)(4) and 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this incidental take statement.

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

8.1 Amount or Extent of Take

We anticipate that continued operation of SLNPP will result in takes of sea turtles and smalltooth sawfish as the animals are entrained into the intake pipes and entrapped in the intake canal. All such takes will be counted as take attributable to the proposed action; for clarity, these takes are termed "captures." Of the captured animals, some may be injured or killed, and causality of injuries or mortalities must be determined. Beyond captures, we anticipate takes resulting from the continued operation of the SLNPP (causal takes) and from activities not related to SLNPP operations (non-causal takes). Non-causal takes are attributed to activities that occur outside of plant operations (e.g., before turtles enter the plant's intake pipes and intake canal) and are distinguishable from causal takes. All freshly injured sea turtles that do not shows signs of injuries from, for example, a boat strike, shark bite, fishing gear interaction, or a cold stunning event are considered injured from the ongoing operation of the SLNPP, and the take of these animals is counted against the causal incidental take authorized in this section of the biological opinion. An animal that survives capture and any causal injury is categorized as a non-lethal take. Non-lethal, causal injuries are categorized as minor, moderate, or severe. Anticipated takes for captures, severe causal injuries, and causal mortalities of sea turtles are quantified (Table 2). Similar logic applies to causality of lethal takes. If the cause of death of an animal is determined

to be from plant operations, the lethal take is causal and counted against authorized incidental take. If the cause of death is determined to be from an activity outside of plant operations before the animal entered an intake pipe, the cause of death is non-causal. Plant biologists have been assessing causality of sea turtle captures at SLNPP since 2001.

Table 2. Incidental Take Limits for Continued Operation of SLNPP.

<table>
<tr><th>Species</th><th>Captures</th><th>Severe Causal Injuries</th><th>Causal Mortalities</th></tr>
<tr><td>Hawksbill Turtle (Eretmochelys imbricata)</td><td>7 annually</td><td colspan="2" rowspan="3">1 every 2 years</td></tr>
<tr><td>Kemp’s Ridley Turtle (Lepidochelys kempii)</td><td>8 annually</td></tr>
<tr><td>Leatherback Turtle (Dermochelys coriacea)</td><td>5 annually</td></tr>
<tr><td>Green Turtle (Chelonia mydas)</td><td>500 annually</td><td>7 annually</td><td>5 annually</td></tr>
<tr><td>Loggerhead Turtle (Caretta caretta) – Northwest Atlantic Ocean Distinct Population Segment</td><td>623 annually</td><td>3 annually</td><td>3 annually</td></tr>
<tr><td>Smalltooth Sawfish (Pristis pectinata)</td><td>1 every 5 years</td><td>1 every 5 years</td><td>0</td></tr>
</table>

8.1.1 Hawksbill, Kemp’s Ridley, and Leatherback Sea Turtle Takes

Based on the sea turtle capture data at the SLNPP from 2001-2015, hawksbill, Kemp’s ridley, and leatherback sea turtles occur in the action area and may be taken by the continued operation of the SLNPP. NMFS expects the proposed action may result in the capture of up to 7 hawksbill, 8 Kemp’s ridley, and 5 leatherback sea turtles annually until March 1, 2036. One causal take (lethal or severe injury) every two years of the three species combined (i.e., one hawksbill, Kemp’s ridley, or leatherback take) is expected. Exceeding either one of these take limits will require reinitiation of consultation with NMFS.

8.1.2 Green and NWA DPS Loggerhead Sea Turtle Takes

Based on the sea turtle capture data at the SLNPP from 2001-2015, green and NWA DPS loggerhead sea turtles occur in the action area and may be taken lethally and non-lethally from the continued operation of the SLNPP. NMFS expects the proposed action to result in capture of up to 500 green and 623 loggerhead sea turtles annually until March 1, 2036. Operation of SLNPP is expected to cause severe injuries to 7 green and 3 loggerhead sea turtles annually until

March 1, 2036. As stated in section 6.3.1.1, all turtles that have sustained injuries (e.g. scrapes) requiring treatment would be sent to a rehabilitation facility after consultation with FWC. Also, the proposed action is expected to result in causal lethal take of up to 5 green and 3 loggerhead sea turtles annually until March 1, 2036. Exceeding any one of the capture, causal non-lethal, or causal lethal take limits will require reinitiation of consultation with NMFS.

8.1.3 Sea Turtle Takes Not Attributed to Operations at the SLNPP

Sea turtles may enter the SLNPP with fishing gear on them, non-fresh shark bite wounds, cold stunned, and boat strike injuries. Dead sea turtle carcasses may also become entrained in the intake canal. Sea turtles are exposed to fishers, boat traffic, natural cold stunning events, disease, and death from actions occurring outside the action area in the Atlantic Ocean. The number of takes caused by actions outside the action area can vary. The FPL staff consult with FWC sea turtle biologists and the STSSN to determine the cause of injury or death on most sea turtles that are found injured or dead at the SLNPP. Injuries or deaths determined by FWC and the STSSN that are not caused by the continued operations of the SLNPP will not be counted against the take limits estimated under this biological opinion.

8.1.4 Takes of U.S. DPS of Smalltooth Sawfish

Based on the smalltooth sawfish capture data, information regarding the single past take of smalltooth sawfish at the SLNPP, and the description of the proposed action, NMFS expects the proposed action to result in the non-lethal capture (regardless of injury) of one smalltooth sawfish every five years from the date of this biological opinion until March 1, 2036. Exceeding the capture limit or having a causal lethal take will require reinitiation of consultation with NMFS.

8.2 Effects of the Take

NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

8.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" (RPMs) are nondiscretionary measures to minimize the amount or extent of incidental take (50 CFR 402.02). The RPMs and terms and conditions are specified as required by 50 CFR 402.14 (i)(1)(ii) and (iv) to document the incidental take by the proposed action and to minimize the impact of that take on sea turtles and smalltooth sawfish. These measures and terms and conditions are non-discretionary, and must be implemented by the NRC in order for the protection of section 7(o)(2) to apply. The NRC has a continuing duty to regulate the activity covered by this incidental take statement. If the NRC fails to adhere to or ensure compliance with the terms and conditions of the incidental take statement through

enforceable terms, the protective coverage of section 7(o)(2) lapses. In order to monitor the impact of the incidental take, the NRC must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement [50 CFR 402.14(i)(3)].

NMFS has determined that the following RPMs are necessary and appropriate to minimize impacts of the incidental take of sea turtles and smalltooth sawfish during the continued operation of the SLNPP.

1. Avoid and Minimize Entrainment into the SLNPP Intake Canal

Entrainment and entrapment of sea turtles and smalltooth sawfish temporarily removes these animals from their natural habitats. Some of the sea turtles are also injured or killed from the ongoing operations at the SLNPP. The NRC must ensure FPL designs, tests, constructs, and implements an excluder device that reduces the number of turtles and smalltooth sawfish that enter the SLNPP intake canal.

2. Avoid and Minimize Injurious or Lethal Take from Entrainment into, Entrapment in, Capture in, and Release from the SLNPP Intake Canal or from Impingement at Intake Wells

a. The NRC must ensure FPL monitors the number of sea turtles and smalltooth sawfish entering the intake canal and documents the injuries that are attributed to biofouling and marine debris during the animals travels through the intake pipes or attributed to net entanglements in the intake canal.

b. The NRC must ensure FPL inspects and maintains the integrity of the 5-in and 8-in mesh barrier nets in the intake canal.

c. The NRC must ensure FPL continues the monitoring and capture program described in section 2.1.1.3 for sea turtles and smalltooth sawfish entrapped in the intake canal.

d. The NRC must ensure FPL coordinates determination of the cause of injury or death of sea turtles with the FWC and/or the STSSN.

e. The NRC must ensure FPL has experienced marine biologists working in the monitoring and capture program.

8.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the NRC must comply with them in order to implement the RPMs (50 CFR 402.14). The NRC has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR 402.14). If the NRC does not comply with the following terms and conditions, protective coverage for the proposed action will lapse and thereby cause the NRC to be in violation of the ESA.

The following terms and conditions implement RPM 1:

1) The NRC must ensure FPL designs, tests, constructs, and implements excluder devices for the intake pipe velocity caps at SLNPP. The FPL must consult with NMFS and NRC on the designs and test results. Within 60 days of receipt of all excluder device design and test information and clarifying discussions, NMFS must agree to the design for the structure before installation at the velocity caps. The excluder devices must be designed to minimize the number of nesting or egg-bearing female sea turtles that enter the intake pipelines. The excluder device must be tested onsite before in-water construction. NMFS must approve the test plan, and the test plan may include use of uninjured turtles or turtles with minor scrapes that are rescued from the SLNPP intake canal, rehabilitated turtles that are ready for release, or aquarium inhabitants. The FPL must submit a report of the testing and coordinate with NMFS and NRC before beginning in-water construction. In-water construction of the excluder devices must begin no later than the first half of 2018. The construction schedule must be submitted to NMFS no later than the first quarter of 2017. Reasonable deviations from this schedule due to human safety (i.e., severe weather, plant operational issues) are acceptable. The FPL must contact NMFS if deviations from this schedule are expected. Unless agreed upon in writing after issuance of this biological opinion, the NMFS reviews related to the excluder devices will be conducted by the headquarters location of NMFS Office of Protected Resources (1315 East-West Highway, Silver Spring, MD 20910).

2) The FPL shall develop a monitoring and maintenance plan to inspect routinely, remove debris and biofouling organisms from, and repair, as needed, the excluder devices. This plan must be agreed upon by the headquarters location of NMFS Office of Protected Resources within 60 days of receipt. Monitoring results and maintenance activity reports must be sent to NMFS Southeast Regional Office (Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701-5505) within 60 days of conducting the activities.

The following terms and conditions implement RPM 2:

1) NRC and/or FPL must promptly (within 24 hours of the take) notify NMFS Southeast Regional Office by telephone, fax, or by e-mail regarding the lethal take of smalltooth sawfish or sea turtles resulting from plant operations. In addition, a take report should be e-mailed to takereport.nmfsser@noaa.gov and endangeredspecies@nrc.gov.

2) Within 6 months of the date of this biological opinion, FPL shall develop a monitoring and maintenance plan to inspect and remove debris and biofouling organisms from the intake pipes based on increased flow rate through the intake pipes and number of fresh scrapes on turtles. This plan must be coordinated with NMFS Southeast Regional Office. The plan may take into account human safety as a valid reason for delays.

3) The FPL shall continue to record the number of captured turtles with fresh causal scrapes and categorize them as minor, moderate, or severe. If the number of turtles with severe fresh scrapes reaches 0.5 percent of the number of captured turtles or if the number of turtles with moderate or severe fresh scrapes reaches 15 percent of the number of captured turtles during two consecutive years, FPL shall start the process for inspecting the intake pipes and evaluate and initiate corrective action within one month. Reasonable deviations from this schedule due to human safety (i.e., severe weather) or intereference with compliance with electrical distribution requirements are acceptable. The FPL must contact NMFS Southeast Regional Office if deviations from this schedule are expected.

4) The existing 8-in mesh barrier net must be retained to serve as a backup to the existing 5-in mesh barrier net, which may fail during algae and jellyfish events. Both nets must be inspected at least quarterly. Both nets must be repaired or replaced as necessary to ensure the integrity of the nets.

5) All FPL's contracted biologists must receive safe handling, transporting, and release training to ensure all marine biologists on staff comply with the Smalltooth Sawfish Handling, Transportation, and Release Protocols (FPL 2007) in addition to sea turtle handling procedures per STSSN.

6) The FPL's contracted biologists must inspect the banks of the intake canal east of the 5-in mesh barrier net for turtle tracks or other signs of nesting each morning during nesting season (March 1-October 31).

7) To the extent practicable and in conditions favorable for clear visibility, FPL's contracted biologists should capture sea turtles in the intake canal by hand or dip net before a turtle encounters a net. Otherwise, capture netting procedures undertaken in the intake canal shall be conducted with surface-floating tangle nets with an unweighted lead line. Any capture nets used must be closely and thoroughly inspected via boat at least hourly. Capture netting shall be conducted when water clarity precludes capture efforts by hand or dip net. Capture netting shall be conducted according to the following schedule whenever sea turtles are present in the intake canal and hand capture efforts are not undertaken:

- a minimum of 8 hours per day, 5 days a week, under normal circumstances
- 12 hours a day or during daylight hours, whichever is less; 7 days per week; under any of the following circumstances:
    - -an adult occurs in the canal during nesting or mating season (March 1 - October 31).
    - -an individual turtle has remained in the canal for 7 days or more.
    - -a sick or injured turtle occurs in the canal.

Reasonable deviations from this schedule due to personnel safety concerns and emergencies are allowed (e.g., during times/events of severe weather, medical emergencies, severe jellyfish intrusions, mandatory meetings for all sea turtle biologists, etc.).

8) The FPL must continue to participate in the STSSN, under the proper authorities, to assess any possible delayed lethal impacts on captured sea turtles and to provide background data on the mortality sources and health of sea turtles in the area. Such participation includes, but is not limited to, monitoring sea turtle nesting activity along the beaches along Hutchinson Island.

9) The FPL must monitor the three-mile stretch of beach along Hutchinson Island near the release site to assess any possible delayed lethal impacts on captured smalltooth sawfish for seven days after the release of a captured animal.

10) The FPL must continue to conduct, under proper permits and authority, the ongoing sea turtle nesting programs and public service turtle walks.

11) If a turtle is observed in the intake canal west of the 8-in barrier net, directed capture efforts shall be undertaken immediately to capture the turtle and to prevent it from entering the intake wells.

12) The grating at each intake well must be visually inspected for sea turtles and smalltooth sawfish every 6 hours during a 24-hour period. If a turtle is sighted in an intake well, dip-netting or other non-injurious capture methods shall be used to remove the turtle. If a smalltooth sawfish is sighted in the intake wells, the sawfish shall be safely captured immediately. Necessary rescue equipment shall be stored on-site within the protected area to expedite capture of a sea turtle or smalltooth sawfish upon sighting.

13) In accordance with the FWC Marine Turtle Permit conditions, the FPL must consult the FWC and/or the STSSN when a sick, injured, or dead sea turtle is captured within the intake canal. The FPL biologist must coordinate the rehabilitation of sick and injured sea turtles with the STSSN. Determinations of the cause of freshly dead turtles should be made by a STSSN veterinarian. Injured animals shall be photographed for documentation. Any dead sea turtle found in the intake canal in a moderately or severely decomposed state will be documented with measurements and photos. FPL will consult FWS to determine whether a necropsy is warranted to determine cause of death for all dead turtles, regardless of condition, recovered from the intake canal. Necropsies must be conducted on all fresh dead sea turtles in the intake canal. Sea turtle mortalities that are determined not to be caused by the operations at the SLNPP will not be counted against the authorized causal take in Section 8.1.

14) The FPL biologists will document the gender of adult sea turtles and take standard measurements of all sea turtles released from the SLNPP. Any existing tags will be noted and reported as appropriate. All sea turtles released from the SLNPP will be tagged with a Passive

Integrated Transponder tag. However, in order to continue to gain data on external metal flipper tag loss rates, turtles greater than 25 cm in carapace length that do not exhibit flipper scarring or damage shall also be flipper tagged using external metal flipper tags. Handling time of the turtles shall be limited to the minimum time necessary to obtain the measurements, tag, and transport the animal back to the Atlantic Ocean. The FPL's contracted biologists must obtain an ESA section 10 (a)(1)(A) scientific permit from NMFS to perform any other in-water research or enhancement activities not specified in this paragraph. The handling and tagging of captured turtles, treatment, and rehabilitation of sick and injured turtles, and disposition of dead turtle carcasses shall be in accordance with permits granted through the state of Florida.

15) The NRC must ensure that Appendix B (Environmental Protection Plan) of each operating license for SLNPP Units 1 and 2 (No. DPR-67 and No. NPF-16, respectively) is revised to incorporate the mandatory terms and conditions of this biological opinion. The 2001 biological opinion for continued operation of SLNPP Units 1 and 2 will be replaced in full with this biological opinion upon issuance. The FPL should request license amendments from NRC to update the Environmental Protection Plans, or NRC should otherwise condition each SLNPP operating license.

16) The FPL must submit to NMFS and the NRC monthly and annual reports providing data and statistics on sea turtle and smalltooth sawfish entrapment, capture efforts, and injuries/mortalities (causal and non-causal). The FPL shall provide NMFS and the NRC with information on inspections and maintenance of barrier nets, excluder devices, and intake pipes. In addition, FPL must submit to NMFS and the NRC an annual operating report summarizing the Taprogge cleaning system operation and any sponge ball loss from plant operations. Regarding studies that involve samples from turtles captured at SLNPP, copies of all annual research reports submitted to FWC and any other publications should be provided to NMFS and the NRC. All such reports and publications shall be sent to the National Marine Fisheries Service Southeast Regional Office, Protected Resources Division, 263 13th Avenue South, St. Petersburg, Florida 33701-5505 and to U.S. Nuclear Regulatory Commission, Document Control Desk, Washington, DC 20555-0001.

9 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02). For the continued operation of the SLNPP, NMFS provides the following conservation recommendations:

1. The NRC should promote FPL's continued efforts to determine post-capture release information on sea turtles and smalltooth sawfish released into the wild.

2. The NRC should promote the improvement of procedures for determining the actual total residency time for captured sea turtles and smalltooth sawfish in the intake canal.

3. The NRC should promote improvements to the Taprogge cleaning system that reduce the amount of sponge balls released into the Atlantic Ocean. For example, FPL should inspect the system to determine why sponge balls are released into the ocean and implement a solution to prevent the sponge balls from escaping.

NMFS requests information on the results of the implementation of any of the conservation recommendations.

10 Reinitiation of Consultation

This concludes formal consultation on the proposed continued operation of the SLNPP in St. Lucie County, Florida. As 50 CFR 402.16 states, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. Additionally, as a result of implementing RPM 1 above, NRC must reinitiate section 7 consultation with NMFS three years after the excluder devices are installed at the velocity caps.

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