UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
https://www.fisheries.noaa.gov/region/southeast

08/08/2022

F/SER31:AL
SERO-2019-03494

Ms. Briana Arlene
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Ref.: The Continued Operation of Florida Power and Light Company's (FPL) St. Lucie Nuclear Power Plant, Unit Numbers 1 and 2, in St. Lucie County, Florida

Dear Ms. Grange:

The enclosed Biological Opinion (Opinion) was prepared by the National Marine Fisheries Service (NMFS) pursuant to Section 7(a)(2) of the Endangered Species Act (ESA). The Opinion considers the effects of the continued operation of the St. Lucie Nuclear Power Plant (SLNPP) on ESA-listed species and designated critical habitat. NMFS concludes that the proposed action may affect, but is not likely to adversely affect, designated critical habitat for the Northwest Atlantic Distinct Population Segment (DPS) of the loggerhead sea turtle. In addition, NMFS concludes that the proposed action is likely to adversely affect, but will not jeopardize the continued existence of the green sea turtle (North Atlantic and South Atlantic Distinct Population Segments [DPSs]), Kemp's ridley sea turtle, loggerhead sea turtle (Northwest Atlantic DPS), hawksbill sea turtle, leatherback sea turtle, giant manta ray, and smalltooth sawfish (United States DPS).

The project has been assigned tracking number SERO-2019-03494 in our NMFS Environmental Consultation Organizer (ECO). Please refer to the ECO number in all future inquiries regarding this project. Please direct questions regarding this Opinion to Audra Livergood, Consultation Biologist, by phone at (786) 351-2225, or by email at Audra.Livergood@noaa.gov.

Sincerely,

STRELCHECK.ANDREW.JAMES.1365863152 Digitally signed by STRELCHECK.ANDREW.JAMES.1365863152 Date: 2022.08.08 17:16:53 -04'00'

Andrew J. Strelcheck
Regional Administrator

Enclosures: Biological Opinion
File: 1514-22 m

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency:	United States Nuclear Regulatory Commission
Applicant:	Florida Power & Light
Activity:	The Continued Operation of the St. Lucie Nuclear Power Plant, Unit Numbers 1 and 2, in St. Lucie County, Florida
Consulting Agency:	National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida Tracking Number SERO-2019-03494
Approved by:	STRELCHECK.ANDREW.JAMES.1365863152 Digitally signed by STRELCHECK.ANDREW.JAMES.1365863152 Date: 2022.08.08 17:18:10 -04'00' Andrew J. Strelcheck, Regional Administrator NMFS, Southeast Regional Office St. Petersburg, Florida
Date Issued:	08/08/2022

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Acronyms and Abbreviations

BA	Biological Assessment
BIRNM	Buck Island Reef National Monument
CFR	Code of Federal Regulations
CTCS	Condenser Tube Cleaning System
CCL	Curved Carapace Length
CITES	Convention on International Trade in Endangered Species of Wild Flora & Fauna
CPUE	Catch Per Unit Effort
DWH	Deepwater Horizon
DPS	Distinct Population Segment
ECO	NMFS Environmental Consultation Organizer
EFH	Essential Fish Habitat
ENP	Everglades National Park
ESA	Endangered Species Act
EEZ	Exclusive Economic Zone
FR	Federal Register
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Florida Fish and Wildlife Research Institute
FPL	Florida Power & Light
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
Opinion	Biological Opinion
PIT	Passive Integrated Transponder (tag)
RAI	Request for Additional Information
SCL	Straight Carapace Length
SLNPP	St. Lucie Nuclear Power Plant
STSSN	Sea Turtle Stranding and Salvage Network (in Florida)
TEWG	Turtle Expert Working Group
U.S.	United States
USFWS	U.S. Fish and Wildlife Service

Units of Measurement

°C	degrees Celsius
cm	centimeter(s)
°F	degrees Fahrenheit
ft	foot/feet
ft^2	square foot/feet
in	inch(es)
km	kilometer(s)
lin ft	linear foot/feet
m	meter(s)

mi	mile(s)
mi^2	square mile(s)

Introduction

Section 7(a)(2) of the ESA of 1973, as amended (16 U.S.C. § 1531 et seq.), requires that each federal agency ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary in carrying out these responsibilities. NOAA NMFS and the USFWS share responsibilities for administering the ESA.

Consultation is required when a federal action agency determines that a proposed action "may affect" listed species or designated critical habitat. Informal consultation is concluded after NMFS determines that the action is not likely to adversely affect listed species or critical habitat. Formal consultation is concluded after NMFS issues a Biological Opinion (Opinion) that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat, in which case reasonable and prudent alternatives to the action as proposed must be identified to avoid these outcomes. The Opinion states the amount or extent of incidental take of the listed species that may occur, develops measures (i.e., reasonable and prudent measures) to reduce the effect of take, and recommends conservation measures to further the recovery of the species.

This document represents NMFS's Opinion based on our review of impacts associated with FPL's continued operation of the SLNPP in St. Lucie County, Florida. This Opinion analyzes the proposed action's effects on threatened and endangered species in accordance with Section 7 of the ESA. We based our Opinion on project information provided by the NRC, FPL, and other sources of information, including the published literature cited herein.

For purposes of this consultation, we considered whether the substantive analysis and its conclusions regarding the effects of the proposed action articulated in the Opinion and its incidental take statement would be any different under the 50 CFR part 402 regulations as they existed prior to the 2019 Rule vacated by the order of the United States District Court for the Northern District of California on July 5, 2022. We have determined that our analysis and conclusions would not be any different.

1 CONSULTATION HISTORY

There is an extended consultation history (dating back to 2001) between the NRC and NMFS on the SLNPP. For this Opinion, we have relied upon the consultation history in NMFS's March 24, 2016 Opinion (NMFS 2016) to the NRC for the continued operation of the SLNPP. We have supplemented the consultation history in the 2016 Opinion with the more recent consultation history outlined below:

November 2, 2017	FPL notified NMFS that they exceeded their 2017 annual allowable take limit for the smalltooth sawfish.
January 30, 2018	FPL notified NMFS that they exceeded their 2018 annual allowable take limit for the Kemp's ridley sea turtle.

February 14, 2018	NRC submitted their initial request to reinitiate ESA Section 7 consultation with NMFS. NMFS initiated consultation on April 3, 2018.
March 22, 2018	NMFS attended a meeting with the NRC and FPL to discuss the NRC's February 14, 2018, request for ESA Section 7 consultation and next steps.
April 24, 2018	NMFS reviewed FPL's draft March 23, 2018, Test Evaluation Report and sent comments to NRC and FPL.
May 2018	FPL notified NMFS that they exceeded their 2018 annual allowable take limit for causal mortalities for the green sea turtle.
May 14, 2018	NMFS attended a meeting with the NRC, FPL, and the Florida Fish and Wildlife Conservation Commission (FWC) to discuss the results of FPL's turtle excluder device testing.
July 16, 2018	NMFS attended a meeting with the NRC and FPL to discuss the status of the ESA Section 7 consultation and next steps.
December 18, 2018	NRC notified NMFS by email withdrawing their request to reinitiate ESA Section 7 consultation on the basis of insufficient information. The email stated NRC would send a new request for consultation once FPL submitted a final report describing and analyzing the results of turtle excluder device testing conducted in 2016 and 2017.
April 14, 2019	FPL notified NMFS that they exceeded their 2019 annual allowable take limit for the Kemp's ridley sea turtle.
April 17, 2019	NRC sent a new request for consultation to NMFS via email. NRC requested that NMFS revise the incidental take statement (ITS) of its 2016 Opinion to address the level of allowable captures of smalltooth sawfish, the level of allowable captures of Kemp's ridley sea turtles, the level of allowable captures of green sea turtles, and the terms and conditions in the 2016 Opinion related to the testing and implementation of excluder devices.
May 8, 2019	NMFS sent a request for additional information (RAI) to the NRC via email.
May 28, 2019	After receiving a complete response to our May 8, 2019 RAI, NMFS initiated ESA Section 7 consultation with the NRC.

September 23, 2019	NMFS sent a letter to the NRC stating that we would not be preparing a new Biological Opinion because we believe the NRC and FPL should fully implement the Reasonable and Prudent Measures and Terms and Conditions in the 2016 Biological Opinion.
November 18, 2019	The NRC sent a new request to reinitiate Section 7 consultation with NMFS. The NRC stated that reinitiation was warranted due to the identified action being modified and due to FPL exceeding the take limits authorized in the ITS of the 2016 Opinion for smalltooth sawfish, green sea turtles, and Kemp's ridley sea turtles. NMFS concurs reinitiation is warranted given it is likely FPL would have exceeded the take limits in the 2016 Opinion for green sea turtles, even with an excluder device, due to the large number of juvenile green sea turtles that inhabit the nearshore waters where the intake velocity caps are located. These juvenile green sea turtles are small enough to pass through the excluder device.
December 13, 2019	NMFS sent an RAI to the NRC via email.
December 18, 2019	NRC responded to NMFS's 12/13/19 RAI; however, NMFS determined the response was incomplete.
January 10, 2020	NMFS reiterated its request for the NRC/FPL to provide an Annual Environmental Operating Report for 2019.
January 14, 2020	NRC sent an interim response to NMFS.
January 22, 2020	NRC sent a complete response to NMFS, and NMFS initiated Section 7 formal consultation.
January 29, 2020	NMFS participated in a teleconference with NRC to discuss a proposed (extended) timeline for completing the current Opinion. NRC agreed, in writing, to the extended timeline via email on January 29, 2020. The extended timeline states NMFS will complete a signed Opinion by December 31, 2020
November 18, 2020	FPL informed NMFS via email of 2 giant manta ray captures at SLNPP. The first capture occurred on September 11, 2020. FPL stated, in their November 18, 2020 summary report, that the animal was released back to the ocean "unharmed." The second capture occurred on October 23, 2020. In their summary report, FPL stated the animal was released back to the ocean "in good condition."
March 31, 2021	NMFS transmitted the Draft Biological Opinion to NRC and FPL for review.

October 1, 2021	NMFS received NRC's and FPL's comments on the Draft Biological Opinion.
April 5, 2022	FPL informed NMFS via email of a lethal take of a subadult Kemp's ridley that occurred on March 14, 2022. According to FPL, the turtle was emaciated and missing its left eye from an old, healed injury. Furthermore, FPL reported the turtle had extensive flipper and carapace damage from old, healed injuries. Despite being severely compromised, a licensed veterinarian determined cause of death was drowning; thus, this take was deemed causal to plant operations.

2 DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

As described in the NRC's April 2019 Biological Assessment (BA) of Impacts to Sea Turtles and Smalltooth Sawfish for the St. Lucie Plant, Numbers 1 and 2, the proposed action is the continued operation of the SLNPP and its ocean intake system under the terms of NRC Renewed Facility Operating License Nos. DPR-67 and NPF-16, which authorize operations through March 1, 2036 (Unit No. 1) and April 6, 2043 (Unit No. 2).

The current NRC licenses for the SLNPP require FPL to comply with the "Terms and Conditions" of NMFS's currently applicable Biological Opinion, which previous to the current Opinion, was dated March 24, 2016. The current Opinion supersedes the 2016 Opinion and applies to the remainder of the current license terms. A description of SLNPP operations and activities follows.

The SLNPP has 2 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 2 nuclear reactors share common surface-level intake and discharge canals with buried ocean pipes.

Intake and Discharge Systems

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

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 (21.3 x 21.3 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 (15.8 x 15.8 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.

Intake Pipelines

From the ocean intake structure, water flows through the 3 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, based on sea turtle fresh scrape trends, 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.

Headwalls and Intake Canal

Approximately 450 ft (138 m) behind the primary dune line, the intake pipelines discharge water at 2 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, where cooling water is drawn into the power plant operating units. 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 most recently replaced in February 2018 after 2 turtles

moved past it to the intake well in October 2017. Sea turtle biologists monitor the net hourly 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 2 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 2 barrier nets are inspected underwater quarterly, and any holes are repaired at that time. The third and last barrier net, the security 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.

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. 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. If other dredging methods and procedures are used, these methods would be agreed upon by FPL, NMFS, and the NRC.

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 4 bays. Each bay contains trash racks and circulating water pumps. The trash racks 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. 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 6 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 approximately 88,000 7/8-in (2.2-cm) diameter tubes. Condenser water heat is transferred to the circulating water, which is then expelled into the discharge canal.

Discharge Systems

Each reactor unit discharges its circulating 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 2 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). In addition to ocean discharge, some additional thermal discharge occurs into the Indian River Lagoon (NMFS 2016 and NRC 2019).

Condenser Tube Cleaning System

Condensers are heat exchangers that cool exhaust steam to form water; condensers comprise many small tubes that require continuous cleaning. The condenser tube cleaning system (CTCS) re-circulates as many as 14,400 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 after they pass through the condenser tubes with the circulating flow. This allows the sponge balls to be continuously reused and minimizes the number of sponge balls that are inadvertently released into the Atlantic Ocean through normal operation. In 2010, average sponge ball loss was 21 per day. 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.

In addition to operations as described above, FPL proposes to implement the following actions to reduce or minimize potential harm to sea turtles, giant manta rays, scalloped hammerhead sharks, and smalltooth sawfish:

1. Perform an initial detailed inspection of the vertical to horizontal transition interior of the

intake pipes and velocity caps to identify conditions that may cause injury to large marine animals that may travel through the pipes.

2. Perform maintenance and modifications to address adverse conditions, to include creation of a smooth transition at the base of the Unit No. 1 velocity caps where the horizontal pipe enters the vertical section of the velocity cap.

3. Perform periodic inspections, based on fresh scrape trends, of the interior of the intake pipes and velocity caps to identify potential conditions that may cause injury to large marine animals.

4. Require biologists to inspect and record observations of the intake canal banks for potential sea turtle nesting and document inspection results in FPL's Annual Environmental Report.

2.2 Action Area

The project site is located on Hutchinson Island, St. Lucie County, Florida (27.34696°N, 80.244493°W [North American Datum 1983]) (Figure 1).

Figure 1. The project site on Hutchinson Island, St. Lucie County, Florida (©2020 Google).

The action area is defined by regulation as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations [CFR] 402.02). For the purposes of this Federal action, 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. 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 (NMFS 2016).

3 STATUS OF LISTED SPECIES AND CRITICAL HABITAT

Table 1 provides the effect determinations for species the NRC and/or NMFS believe may be affected by the proposed action.

Table 1. Effects Determination(s) for Species the Action Agency and/or NMFS Believe May Be Affected by the Proposed Action

Species	ESA Listing Status[1]	Action Agency Effect Determination	NMFS Effect Determination
Sea Turtles			
Green (North Atlantic Distinct Population Segment [NA DPS])	T	LAA	LAA
Green [South Atlantic (SA) DPS]	T	LAA	LAA
Kemp's ridley	E	LAA	LAA
Loggerhead (Northwest Atlantic DPS)	T	LAA	LAA
Hawksbill	E	LAA	LAA
Leatherback	E	LAA	LAA
Olive ridley	T	LAA	NLAA
Fish			
Smalltooth sawfish (United States [U.S.] DPS)	E	LAA	LAA
Giant manta ray	T	ND	LAA

NMFS believes it is extremely unlikely that another olive ridley sea turtle will be incidentally captured at the SLNPP because Florida is outside the general range of this species. There have been a few historical reported strandings (e.g., Texas) of unknown population origin, and even some possible doubt regarding identification of at least 1 stranding. While 1 confirmed take of an olive ridley in pelagic longline fisheries occurred in 2003, that is considered an aberration. We are aware that FPL reported capturing a healthy olive ridley at the SLNPP in 2019. The individual was fitted with a Passive Integrated Transponder (i.e., PIT tag) and released back to the wild. In spite of this 1 instance of an olive ridley capture at SLNPP (in the 44 years since SLNPP Unit 1 has been operating), NMFS does not expect olive ridley sea turtles to be present in the action area; therefore, we conclude it is extremely unlikely that another olive ridley will be captured in the future at the plant.

[1] T = Threatened; E = Endangered; LAA = may affect, and is likely to adversely affect; ND = no determination made.

3.1 Potential Routes of Effect Not Likely to Adversely Affect Critical Habitat

The action area is located in designated critical habitat for the Northwest Atlantic (NWA) DPS of the loggerhead sea turtle. NMFS analyzed effects on critical habitat for the NWA DPS of the loggerhead sea turtle in our March 24, 2016 Biological Opinion (NMFS 2016). As stated in our 2016 Opinion, the critical habitat in the action area includes nearshore reproductive and constricted migratory corridor habitats. The following essential features/primary constituent elements (PCEs) are present in nearshore reproductive habitat:

1) Nearshore waters with direct proximity to nesting beaches that support critical aggregations of nesting turtles (e.g., highest density nesting beaches) to 1.6 kilometer (1 mile) offshore
2) Waters sufficiently free of obstructions or artificial lighting to allow transit through the surf zone and outward toward open water
3) Waters with minimal man-made structures that could promote predators (i.e., nearshore predator concentration caused by submerged and emergent offshore structures), disrupt wave patterns necessary for orientation, and/or create excessive longshore currents

The following PCEs are present in constricted migratory corridor habitat:

1) Constricted continental shelf area relative to nearby continental shelf waters that concentrate migratory pathways
2) Passage conditions to allow for migration to and from nesting, breeding, and/or foraging areas

The intake and discharge pipelines have small structural footprints that do not affect any of the nearshore reproductive PCEs or the constricted migratory habitat PCEs. Likewise, as described in section 2, the thermal plume affects only a very small area, which is a negligible amount of the critical habitat. We believe the continued operation of SLNPP would not result in any changes to the area and would not alter any of the PCEs or reduce the conservation value of the critical habitat. Therefore, we conclude the proposed action would have an insignificant effect on designated critical habitat for the NWA DPS of the loggerhead sea turtle.

3.2 Status of Species Likely to be Adversely Affected

Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its entire range on June 2, 1970, (35 FR 8491) under the Endangered Species Conservation Act of 1969.

Species Description and Distribution

The leatherback is the largest sea turtle in the world, with a curved carapace length (CCL) that often exceeds 5 ft (150 cm) and front flippers that can span almost 9 ft (270 cm) (NMFS and USFWS 1998a). Mature males and females can reach lengths of over 6 ft (2 m) and weigh close to 2,000 lb (900 kg). The leatherback does not have a bony shell. Instead, its shell is approximately 1.5 in (4 cm) thick and consists of a leathery, oil-saturated connective tissue

overlaying loosely interlocking dermal bones. The ridged shell and large flippers help the leatherback during its long-distance trips in search of food.

Unlike other sea turtles, leatherbacks have several unique traits that enable them to live in cold water. For example, leatherbacks have a countercurrent circulatory system (Greer et al. 1973),[2] a thick layer of insulating fat (Davenport et al. 1990; Goff and Lien 1988), gigantothermy (Paladino et al. 1990),[3] and they can increase their body temperature through increased metabolic activity (Bostrom and Jones 2007; Southwood et al. 2005). These adaptations allow leatherbacks to be comfortable in a wide range of temperatures, which helps them to travel further than any other sea turtle species (NMFS and USFWS 1995). For example, a leatherback may swim more than 6,000 miles (10,000 km) in a single year (Benson et al. 2007a; Benson et al. 2011; Eckert 2006; Eckert et al. 2006). They search for food between latitudes 71°N and 47°S in all oceans, and travel extensively to and from their tropical nesting beaches. 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 2001).

While leatherbacks will look for food in coastal waters, they appear to prefer the open ocean at all life stages (Heppell et al. 2003). Leatherbacks have pointed tooth-like cusps and sharp-edged jaws that are adapted for a diet of soft-bodied prey such as jellyfish and salps. A leatherback's mouth and throat also have backward-pointing spines that help retain jelly-like prey. Leatherbacks' favorite prey are jellies (e.g., medusae, siphonophores, and salps), which commonly occur in temperate and northern or sub-arctic latitudes and likely has a strong influence on leatherback distribution in these areas (Plotkin 2003). Leatherbacks are known to be deep divers, with recorded depths in excess of a half-mile (Eckert et al. 1989), but they may also come into shallow waters to locate prey items.

Genetic analyses using microsatellite markers along with mitochondrial DNA and tagging data indicate there are 7 groups or breeding populations in the Atlantic Ocean: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). General differences in migration patterns and foraging grounds may occur between the 7 nesting assemblages, although data to support this is limited in most cases.

Life History Information

The leatherback life cycle is broken into several stages: (1) egg/hatchling, (2) post-hatchling, (3) juvenile, (4) subadult, and (5) adult. Leatherbacks are a long-lived species that delay age of maturity, have low and variable survival in the egg and juvenile stages, and have relatively high and constant annual survival in the subadult and adult life stages (Chaloupka 2002; Crouse 1999; Heppell et al. 1999; Heppell et al. 2003; Spotila et al. 1996; Spotila et al. 2000). While a robust estimate of the leatherback sea turtle's life span does not exist, the current best estimate for the maximum age is 43 (Avens et al. 2009). It is still unclear when leatherbacks first become

[2] Countercurrent circulation is a highly efficient means of minimizing heat loss through the skin's surface because heat is recycled. For example, a countercurrent circulation system often has an artery containing warm blood from the heart surrounded by a bundle of veins containing cool blood from the body's surface. As the warm blood flows away from the heart, it passes much of its heat to the colder blood returning to the heart via the veins. This conserves heat by recirculating it back to the body's core.

[3] "Gigantothermy" refers to a condition when an animal has relatively high volume compared to its surface area, and as a result, it loses less heat.

sexually mature. Using skeletochronological data, Avens et al. (2009) estimated that leatherbacks in the western North Atlantic may not reach maturity until 29 years of age, which is longer than earlier estimates of 2-3 years by Pritchard and Trebbau (1984), of 3-6 years by Rhodin (1985), of 13-14 years for females by Zug and Parham (1996), and 12-14 years for leatherbacks nesting in the U.S. Virgin Islands by Dutton et al. (2005). A more recent study that examined leatherback growth rates estimated an age at maturity of 16.1 years (Jones et al. 2011).

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

Female leatherbacks typically nest on sandy, tropical beaches at intervals of 2-4 years (Garcia M. and Sarti 2000; McDonald and Dutton 1996; Spotila et al. 2000). Unlike other sea turtle species, female leatherbacks do not always nest at the same beach year after year; some females may even nest at different beaches during the same year (Dutton et al. 2005; Eckert 1989; Keinath and Musick 1993; Steyermark et al. 1996). Individual female leatherbacks have been observed with fertility spans as long as 25 years (Hughes 1996). Females usually lay up to 10 nests during the 3-6 month nesting season (March through July in the United States), typically 8-12 days apart, with 100 eggs or more per nest (Eckert et al. 2012; Eckert 1989; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). Yet, up to approximately 30% of the eggs may be infertile (Eckert 1989; Eckert et al. 1984; Maharaj 2004; Matos 1986; Stewart and Johnson 2006; Tucker 1988). The number of leatherback hatchlings that make it out of the nest on to the beach (i.e., emergent success) is approximately 50% worldwide (Eckert et al. 2012), which is lower than the greater than 80% reported for other sea turtle species (Miller 1997). In the United States, the emergent success is higher at 54-72% (Eckert and Eckert 1990; Stewart and Johnson 2006; Tucker 1988). Thus, the number of hatchlings in a given year may be less than the total number of eggs produced in a season. Eggs hatch after 60-65 days, and the hatchlings have white striping along the ridges of their backs and on the edges of the flippers. Leatherback hatchlings weigh approximately 1.5-2 oz (40-50 g), and have lengths of approximately 2-3 in (51-76 mm), with fore flippers as long as their bodies. Hatchlings grow rapidly, with reported growth rates for leatherbacks from 2.5-27.6 in (6-70 cm) in length, estimated at 12.6 in (32 cm) per year (Jones et al. 2011).

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

The survival and mortality rates for leatherbacks are difficult to estimate and vary by location. For example, the annual mortality rate for leatherbacks that nested at Playa Grande, Costa Rica, was estimated to be 34.6% in 1993-1994, and 34.0% in 1994-1995 (Spotila et al. 2000). In contrast, leatherbacks nesting in French Guiana and St. Croix had estimated annual survival rates

of 91% (Rivalan et al. 2005) and 89% (Dutton et al. 2005), respectively. For the St. Croix population, the average annual juvenile survival rate was estimated to be approximately 63% and the total survival rate from hatchling to first year of reproduction for a female was estimated to be between 0.4% and 2%, assuming age at first reproduction is between 9-13 years (Eguchi et al. 2006). Spotila et al. (1996) estimated first-year survival rates for leatherbacks at 6.25%.

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

Status and Population Dynamics

The status of the Atlantic leatherback population had been less clear than the Pacific population, which has shown dramatic declines at many nesting sites (Spotila et al. 2000; Santidrián Tomillo et al. 2007; Sarti Martínez et al. 2007). This uncertainty resulted from inconsistent beach and aerial surveys, cycles of erosion, and reformation of nesting beaches in the Guianas (representing the largest nesting area). Leatherbacks also show a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species. Coordinated efforts of data collection and analyses by the leatherback Turtle Expert Working Group helped to clarify the understanding of the Atlantic population status up through the early 2000's (TEWG 2007). However, additional information for the Northwest Atlantic population has more recently shown declines in that population as well, contrary to what earlier information indicated (Northwest Atlantic Leatherback Working Group 2018). A full status review covering leatherback status and trends for all populations worldwide is being finalized (2020).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with most of the nesting occurring in the Guianas and Trinidad. The Southern Caribbean/Guianas stock of leatherbacks was designated after genetics studies indicated that animals from the Guianas (and possibly Trinidad) should be viewed as a single population. Using nesting females as a proxy for population, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate. TEWG observed positive growth within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007). More specifically, Tiwari et al. (2013) report an estimated three-generation abundance change of +3%, +20,800%, +1,778%, and +6% in Trinidad, Guyana, Suriname, and French Guiana, respectively. However, subsequent analysis using data up through 2017 has shown decreases in this stock, with an annual geometric mean decline of 10.43% over what they described as the short term (2008-2017) and a long-term (1990-2017) annual geometric mean decline of 5% (Northwest Atlantic Leatherback Working Group 2018).

Researchers believe the cyclical pattern of beach erosion and then reformation has affected leatherback nesting patterns in the Guianas. For example, between 1979 and 1986, the number of leatherback nests in French Guiana had increased by about 15% annually (NMFS 2001). This increase was then followed by a nesting decline of about 15% annually. This decline corresponded with the erosion of beaches in French Guiana and increased nesting in Suriname. This pattern suggests that the declines observed since 1987 might actually be a part of a nesting cycle that coincides with cyclic beach erosion in Guiana (Schulz 1975). Researchers think that the cycle of erosion and reformation of beaches may have changed where leatherbacks nest throughout this region. The idea of shifting nesting beach locations was supported by increased nesting in Suriname,[4] while the number of nests was declining at beaches in Guiana (Hilterman et al. 2003). This information suggested the long-term trend for the overall Suriname and French Guiana population was increasing. A more recent cycle of nesting declines from 2008-2017, as high at 31% annual decline in the Awala-Yalimapo area of French Guiana and almost 20% annual declines in Guyana, has changed the long-term nesting trends in the region negative as described above (Northwest Atlantic Leatherback Working Group 2018).

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. Across the Western Caribbean, nesting is most prevalent in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coastline of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from index nesting beaches in Tortuguero, Gandoca, and Pacuaré in Costa Rica indicate that the nesting population likely was not growing over the 1995-2005 time series (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8% decline between 1995 and 2006 (Troëng et al. 2007). Tiwari et al. (2013) report an estimated three-generation abundance change of -72%, -24%, and +6% for Tortuguero, Gandoca, and Pacuare, respectively. Further decline of almost 6% annual geometric mean from 2008-2017 reflects declines in nesting beaches throughout this stock (Northwest Atlantic Leatherback Working Group 2018).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, St. Croix (U.S. Virgin Islands), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1% (TEWG 2007). Tiwari et al. (2013) report an estimated three-generation abundance change of -4% and +5,583% at Culebra and Fajardo, respectively. At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has varied from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1% from 1986-2004 (TEWG 2007). From 2006-2010, Tiwari et al. (2013) report an annual growth rate of +7.5% in St. Croix and a three-generation abundance change of +1,058%. Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2% between 1994 and 2004 (TEWG 2007). The nesting trend reversed course later, with an annual geometric mean decline of 10% from 2008-2017 driving the long-term trend (1990-2017) down to a 2% annual decline (Northwest Atlantic Leatherback Working Group 2018).

[4] Leatherback nesting in Suriname increased by more than 10,000 nests per year since 1999 with a peak of 30,000 nests in 2001.

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17% between 1989 and 2005. FWC Index Nesting Beach Survey Data generally indicates biennial peaks in nesting abundance beginning in 2007 (Figure 2 and Table 2). A similar pattern was also observed statewide (Table 2). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting. Overall, the trend showed growth on Florida's east coast beaches. Tiwari et al. (2013) report an annual growth rate of 9.7% and a three-generation abundance change of +1,863%. However, in recent years nesting has declined on Florida beaches, with 2017 hitting a decade-low number, with a partial rebound in 2018. The annual geometric mean trend for Florida has been a decline of almost 7% from 2008-2017, but the long-term trend (1990-2017) remains positive with an annual geometric mean increase of over 9% (Northwest Atlantic Leatherback Working Group 2018).

Table 2. Number of Leatherback Sea Turtle Nests in Florida

Leatherback Nests Recorded- Florida		
Year	**Index Nesting Beach Survey**	**Statewide Survey**
2011	625	1,653
2012	515	1,712
2013	322	896
2014	641	1,604
2015	489	1,493
2016	319	1,054
2017	205	663
2018	316	949
2019	337	1,105
2020	467	1,652
2021	435	FWC website only has statewide data through 2020

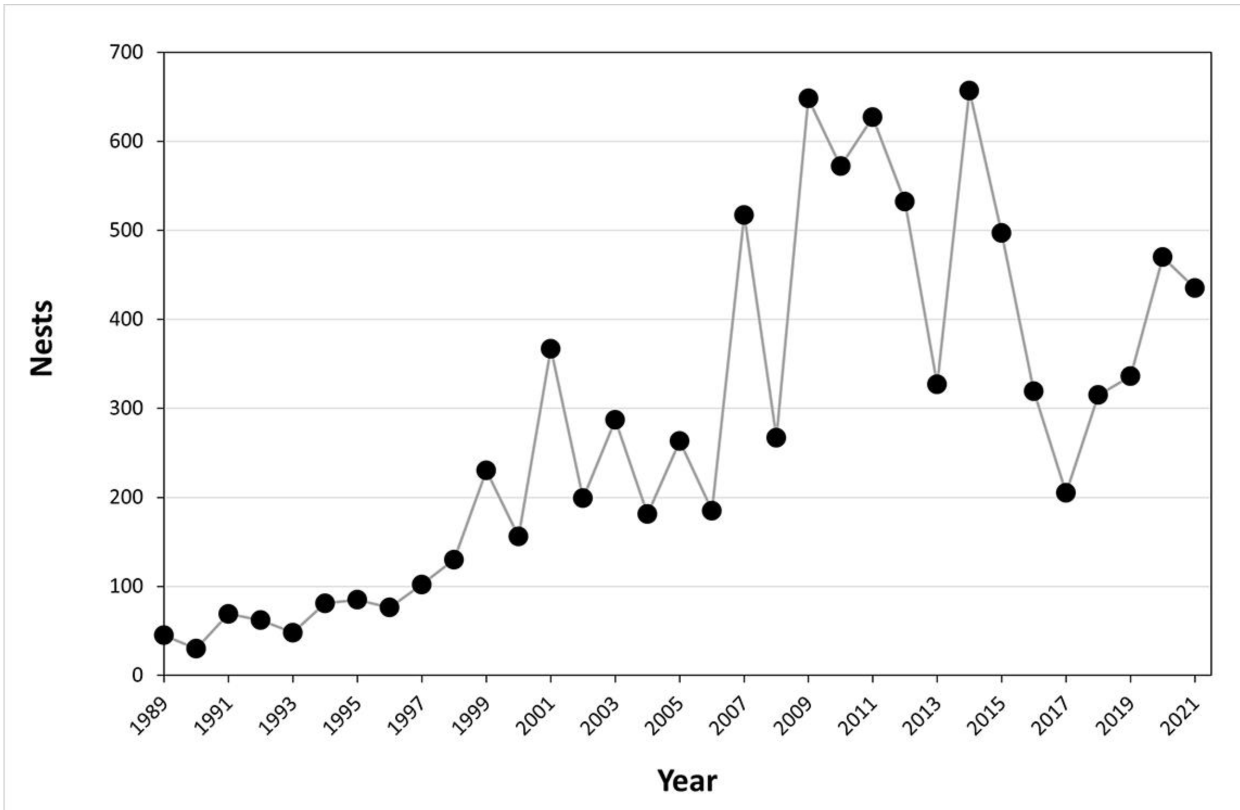

Figure 2. Leatherback sea turtle nesting at Florida index beaches since 1989

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

Two other small but growing stocks nest on the beaches of Brazil and South Africa. Based on the data available, TEWG (2007) determined that between 1988 and 2003, there was a positive annual average growth rate between 1.07% and 1.08% for the Brazilian stock. TEWG (2007) estimated an annual average growth rate between 1.04% and 1.06% for the South African stock.

Because the available nesting information is inconsistent, it is difficult to estimate the total population size for Atlantic leatherbacks. Spotila et al. (1996) characterized the entire Western Atlantic population as stable at best and estimated a population of 18,800 nesting females. Spotila et al. (1996) further estimated that the adult female leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, was about 27,600 (considering both nesting and interesting females), with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007). TEWG (2007) also determined that at the time of their publication, leatherback sea turtle populations in the Atlantic were all stable or increasing with the exception of the Western Caribbean and West

Africa populations. A later review by NMFS and USFWS (2013) suggested the leatherback nesting population was stable in most nesting regions of the Atlantic Ocean. However, as described earlier, the Northwest Atlantic population has experienced declines over the near term (2008-2017), often severe enough to reverse the longer term trends to negative where increases had previously been seen (Northwest Atlantic Leatherback Working Group 2018). Given the relatively large size of the Northwest Atlantic population, it is likely that the overall Atlantic leatherback trend is no longer increasing.

Threats

Leatherbacks face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching, global climate change, fisheries interactions, natural predation, and disease. This section expands on a few of the aforementioned threats and how they may specifically impact leatherback sea turtles.

Of all sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear, especially gillnet and pot/trap lines. This vulnerability may be because of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, their method of locomotion, and/or their attraction to the lightsticks used to attract target species in longline fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine and many other stranded individuals exhibited evidence of prior entanglement (Dwyer et al. 2003). Zug and Parham (1996) point out that a combination of the loss of long-lived adults in fishery-related mortalities and a lack of recruitment from intense egg harvesting in some areas has caused a sharp decline in leatherback sea turtle populations. This represents a significant threat to survival and recovery of the species worldwide.

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

Global climate change can be expected to have various impacts on all sea turtles, including leatherbacks. Global climate change is likely to also influence the distribution and abundance of

jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007a). Several studies have shown leatherback distribution is influenced by jellyfish abundance (Houghton et al. 2006; Witt et al. 2007; Witt et al. 2006); however, more studies need to be done to monitor how changes to prey items affect distribution and foraging success of leatherbacks so population-level effects can be determined.

Here we consider specific impacts of the Deepwater Horizon (DWH) oil spill on leatherback sea turtles. Available information indicates leatherback sea turtles (along with hawksbill turtles) were likely directly affected by the oil spill. Leatherbacks were documented in the spill area, but the number of affected leatherbacks was not estimated due to a lack of information compared to other species. Given that the northern Gulf of Mexico is important habitat for leatherback migration and foraging (TEWG 2007), and documentation of leatherbacks in the DWH oil spill zone during the spill period, it was concluded that leatherbacks were exposed to DWH oil, and some portion of those exposed leatherbacks likely died. Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred. Although adverse impacts likely occurred to leatherbacks, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event may be relatively low. Thus, a population-level impact may not have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

Hawksbill Sea Turtle

The hawksbill sea turtle was listed as endangered throughout its entire range on June 2, 1970 (35 FR 8491), under the Endangered Species Conservation Act of 1969, a precursor to the ESA. Critical habitat was designated on June 2, 1998, in coastal waters surrounding Mona and Monito Islands in Puerto Rico (63 FR 46693).

Species Description and Distribution

Hawksbill sea turtles are small- to medium-sized (99-150 lb on average [45-68 kg]) although females nesting in the Caribbean are known to weigh up to 176 lb (80 kg) (Pritchard et al. 1983). The carapace is usually serrated and has a “tortoise-shell” coloring, ranging from dark to golden brown, with streaks of orange, red, and/or black. The plastron of a hawksbill turtle is typically yellow. The head is elongated and tapers to a point, with a beak-like mouth that gives the species its name. The shape of the mouth allows the hawksbill turtle to reach into holes and crevices of coral reefs to find sponges, their primary adult food source, and other invertebrates. The shells of hatchlings are 1.7 in (42 mm) long, are mostly brown, and are somewhat heart-shaped (Eckert 1995; Hillis and Mackay 1989; van Dam and Sarti 1989).

Hawksbill sea turtles have a circumtropical distribution and usually occur between latitudes 30°N and 30°S in the Atlantic, Pacific, and Indian Oceans. In the western Atlantic, hawksbills are widely distributed throughout the Caribbean Sea, off the coasts of Florida and Texas in the continental United States, in the Greater and Lesser Antilles, and along the mainland of Central

America south to Brazil (Amos 1989; Groombridge and Luxmoore 1989; Lund 1985; Meylan and Donnelly 1999; NMFS and USFWS 1998; Plotkin and Amos 1990; Plotkin and Amos 1988). They are highly migratory and use a wide range of habitats during their lifetimes (Musick and Limpus 1997; Plotkin 2003). Adult hawksbill sea turtles are capable of migrating long distances between nesting beaches and foraging areas. For instance, a female hawksbill sea turtle tagged at Buck Island Reef National Monument (BIRNM) in St. Croix was later identified 1,160 miles (1,866 km) away in the Miskito Cays in Nicaragua (Spotila 2004).

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

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

Life History Information

Hawksbill sea turtles exhibit slow growth rates although they are known to vary within and among populations from a low of 0.4-1.2 in (1-3 cm) per year, measured in the Indo-Pacific (Chaloupka and Limpus 1997; Mortimer et al. 2003; Mortimer et al. 2002; Whiting 2000), to a high of 2 in (5 cm) or more per year, measured at some sites in the Caribbean (Diez and Van Dam 2002; León and Diez 1999). Differences in growth rates are likely due to differences in diet and/or density of sea turtles at foraging sites and overall time spent foraging (Bjorndal and Bolten 2002; Chaloupka et al. 2004). Consistent with slow growth, age to maturity for the species is also long, taking between 20 and 40 years, depending on the region (Chaloupka and Musick 1997; Limpus and Miller 2000). Hawksbills in the western Atlantic are known to mature faster (i.e., 20 or more years) than sea turtles found in the Indo-Pacific (i.e., 30-40 years) (Boulan 1983; Boulon Jr. 1994; Diez and Van Dam 2002; Limpus and Miller 2000). Males are typically mature when their length reaches 27 in (69 cm), while females are typically mature at 30 in (75 cm) (Eckert et al. 1992; Limpus 1992).

Female hawksbills return to the beaches where they were born (natal beaches) every 2-3 years to nest (Van Dam et al. 1991; Witzell 1983) and generally lay 3-5 nests per season (Richardson et al. 1999). Compared with other sea turtles, the number of eggs per nest (clutch) for hawksbills can be quite high. The largest clutches recorded for any sea turtle belong to hawksbills (approximately 250 eggs per nest) ((Hirth and Latif 1980), though nests in the U.S. Caribbean and Florida more typically contain approximately 140 eggs (USFWS hawksbill fact sheet, https://www.fws.gov/species/carey-eretmochelys-imbricata). Eggs incubate for approximately 60 days before hatching (USFWS hawksbill fact sheet). Hatchling hawksbill sea turtles typically measure 1-2 in (2.5-5 cm) in length and weigh approximately 0.5 oz (15 g).

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

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

Status and Population Dynamics

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

Island and Vieques Island in Puerto Rico, the mainland of Puerto Rico, and additional beaches on St. Croix, St. John, and St. Thomas, U.S. Virgin Islands.

Mortimer and Donnelly (2008) reviewed nesting data for 83 nesting concentrations organized among 10 different ocean regions (i.e., Insular Caribbean, Western Caribbean Mainland, Southwestern Atlantic Ocean, Eastern Atlantic Ocean, Southwestern Indian Ocean, Northwestern Indian Ocean, Central Indian Ocean, Eastern Indian Ocean, Western Pacific Ocean, Central Pacific Ocean, and Eastern Pacific Ocean). They determined historic trends (i.e., 20-100 years ago) for 58 of the 83 sites, and also determined recent abundance trends (i.e., within the past 20 years) for 42 of the 83 sites. Among the 58 sites where historic trends could be determined, all showed a declining trend during the long-term period. Among the 42 sites where recent (past 20 years) trend data were available, 10 appeared to be increasing, 3 appeared to be stable, and 29 appeared to be decreasing. With respect to regional trends, nesting populations in the Atlantic (especially in the Insular Caribbean and Western Caribbean Mainland) are generally doing better than those in the Indo-Pacific regions. For instance, 9 of the 10 sites that showed recent increases are located in the Caribbean. Buck Island and St. Croix's East End beaches support 2 remnant populations of between 17-30 nesting females per season (Hillis and Mackay 1989; Mackay 2006). While the proportion of hawksbills nesting on Buck Island represents a small proportion of the total hawksbill nesting occurring in the greater Caribbean region, Mortimer and Donnelly (2008) report an increasing trend in nesting at that site based on data collected from 2001-2006. The conservation measures implemented when BIRNM was expanded in 2001 most likely explains this increase.

Nesting concentrations in the Pacific Ocean appear to be performing the worst of all regions despite the fact that the region currently supports more nesting hawksbills than either the Atlantic or Indian Oceans (Mortimer and Donnelly 2008). While still critically low in numbers, sightings of hawksbills in the eastern Pacific appear to have been increasing since 2007, though some of that increase may be attributable to better observations (Gaos et al. 2010). More information about site-specific trends can be found in the most recent 5-year status review for the species (NMFS and USFWS 2007b).

Threats

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

Here we discuss specific impacts of the DWH oil spill on hawksbill turtles. Hawksbills made up 2.2% (8,850) of small juvenile sea turtle (of those that could be identified to species) exposures to oil in offshore areas, with an estimate of 615 to 3,090 individuals dying as a result of the direct exposure (DWH Trustees 2015). No quantification of large benthic juveniles or adults was made. Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available

to determine the extent of those impacts, if they occurred. Although adverse impacts occurred to hawksbills, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event is relatively low, and thus a population-level impact is not believed to have occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

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

The continuing demand for the hawksbills' shells as well as other products derived from the species (e.g., leather, oil, perfume, and cosmetics) represents an ongoing threat to its recovery. The British Virgin Islands, Cayman Islands, Cuba, Haiti, and the Turks and Caicos Islands (United Kingdom) all permit some form of legal take of hawksbill sea turtles. In the northern Caribbean, hawksbills continue to be harvested for their shells, which are often carved into hair clips, combs, jewelry, and other trinkets (Márquez M. 1990; Stapleton and Stapleton 2006). Additionally, hawksbills are harvested for their eggs and meat, while whole, stuffed sea turtles are sold as curios in the tourist trade. Hawksbill sea turtle products are openly available in the Dominican Republic and Jamaica, despite a prohibition on harvesting hawksbills and their eggs (Fleming 2001). Up to 500 hawksbills per year from 2 harvest sites within Cuba were legally captured each year until 2008 when the Cuban government placed a voluntary moratorium on the sea-turtle fishery (Carillo et al. 1999; Mortimer and Donnelly 2008). While current nesting trends are unknown, the number of nesting females is suspected to be declining in some areas (Carillo et al. 1999; Moncada et al. 1999). International trade in the shell of this species is prohibited between countries that have signed the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), but illegal trade still occurs and remains an ongoing threat to hawksbill survival and recovery throughout its range.

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

Kemp's Ridley Sea Turtle

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

Species Description and Distribution

The Kemp's ridley sea turtle is the smallest of all sea turtles. Adults generally weigh less than 100 lb (45 kg) and have a carapace length of around 2.1 ft (65 cm). Adult Kemp's ridley shells are almost as wide as they are long. Coloration changes significantly during development from the grey-black dorsum and plastron of hatchlings, a grey-black dorsum with a yellowish-white plastron as post-pelagic juveniles, and then to the lighter grey-olive carapace and cream-white or yellowish plastron of adults. There are 2 pairs of prefrontal scales on the head, 5 vertebral scutes, usually 5 pairs of costal scutes, and generally 12 pairs of marginal scutes on the carapace. In each bridge adjoining the plastron to the carapace, there are 4 scutes, each of which is perforated by a pore.

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

The primary range of Kemp's ridley sea turtles is within the Gulf of Mexico basin, though they also occur in coastal and offshore waters of the U.S. Atlantic Ocean. Juvenile Kemp's ridley sea turtles, possibly carried by oceanic currents, have been recorded as far north as Nova Scotia. Historic records indicate a nesting range from Mustang Island, Texas, in the north to Veracruz, Mexico, in the south. Kemp's ridley sea turtles have recently been nesting along the Atlantic Coast of the United States, with nests recorded from beaches in Florida, Georgia, and the Carolinas. In 2012, the first Kemp's ridley sea turtle nest was recorded in Virginia. The Kemp's ridley nesting population had been exponentially increasing prior to the recent low nesting years, which may indicate that the population had been experiencing a similar increase. Additional nesting data in the coming years will be required to determine what the recent nesting decline means for the population trajectory.

Life History Information

Kemp's ridley sea turtles share a general life history pattern similar to other sea turtles. Females lay their eggs on coastal beaches where the eggs incubate in sandy nests. After 45-58 days of embryonic development, the hatchlings emerge and swim offshore into deeper, ocean water where they feed and grow until returning at a larger size. Hatchlings generally range from 1.65-1.89 in (42-48 mm) straight carapace length (SCL), 1.26-1.73 in (32-44 mm) in width, and 0.3-0.4 lb (15-20 g) in weight. Their return to nearshore coastal habitats typically occurs around 2 years of age (Ogren 1989), although the time spent in the oceanic zone may vary from 1-4 years or perhaps more (TEWG 2000). Juvenile Kemp's ridley sea turtles use these nearshore coastal habitats from April through November, but they move towards more suitable overwintering habitat in deeper offshore waters (or more southern waters along the Atlantic coast) as water temperature drops.

The average rates of growth may vary by location, but generally fall within 2.2-2.9 ± 2.4 in per year (5.5-7.5 ± 6.2 cm/year) (Schmid and Barichivich 2006; Schmid and Woodhead 2000). Age to sexual maturity ranges greatly from 5-16 years, though NMFS et al. (2011) determined the best estimate of age to maturity for Kemp's ridley sea turtles was 12 years. It is unlikely that most adults grow very much after maturity. While some sea turtles nest annually, the weighted mean remigration rate for Kemp's ridley sea turtles is approximately 2 years. Nesting generally occurs from April to July. Females lay approximately 2.5 nests per season with each nest containing approximately 100 eggs (Márquez M. 1994).

Population Dynamics

Of the 7 species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the beaches of Rancho Nuevo, Mexico (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, however, nesting numbers from Rancho Nuevo and adjacent Mexican beaches were below 1,000, with a low of 702 nests in 1985. Yet, nesting steadily increased through the 1990s, and then accelerated during the first decade of the twenty-first century (Figure 3), which indicates the species is recovering.

It is worth noting that when the Bi-National Kemp's Ridley Sea Turtle Population Restoration Project was initiated in 1978, only Rancho Nuevo nests were recorded. In 1988, nesting data from southern beaches at Playa Dos and Barra del Tordo were added. In 1989, data from the northern beaches of Barra Ostionales and Tepehuajes were added, and most recently in 1996, data from La Pesca and Altamira beaches were recorded. Currently, nesting at Rancho Nuevo accounts for just over 81% of all recorded Kemp's ridley nests in Mexico. Following a significant, unexplained 1-year decline in 2010, Kemp's ridley nests in Mexico increased to 21,797 in 2012 (Gladys Porter Zoo 2013). From 2013 through 2014, there was a second significant decline, as only 16,385 and 11,279 nests were recorded, respectively. More recent data, however, indicated an increase in nesting. In 2015 there were 14,006 recorded nests, and in 2016 overall numbers increased to 18,354 recorded nests (Gladys Porter Zoo 2016). There was a record high nesting season in 2017, with 24,570 nests recorded (J. Pena, pers. comm., August 31, 2017), but nesting for 2018 declined to 17,945, with another steep drop to 11,090 nests in 2019 (Gladys Porter Zoo data, 2019). Nesting numbers rebounded in 2020 (18,068 nests) and 2021 (17,671 nests) (CONAMP data, 2021). At this time, it is unclear whether the increases and declines in nesting seen over the past decade represents a population oscillating around an equilibrium point or if nesting will decline or increase in the future.

A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 353 nests in 2017 (National Park Service data). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, but with a rebound in 2015, the record nesting in 2017, and then a drop back down to 190 nests in 2019, rebounding to 262 nests in 2020, and back to 195 nests in 2021 (National Park Service data).

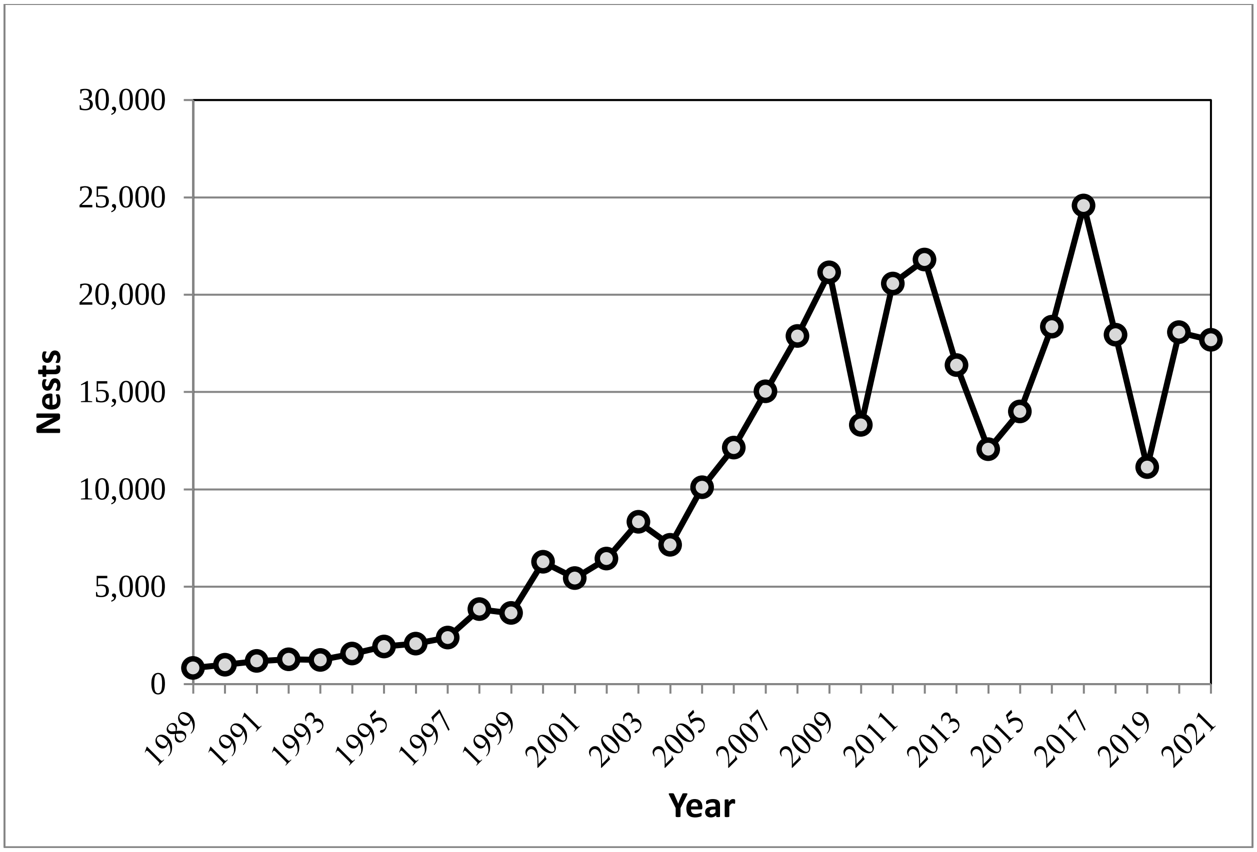

Figure 3. Kemp's ridley nest totals from Mexican beaches (Gladys Porter Zoo nesting database 2019 and CONAMP data 2020, 2021)

Through modeling, Heppell et al. (2005) predicted the population is expected to increase at least 12-16% per year and could reach at least 10,000 females nesting on Mexico beaches by 2015. NMFS et al. (2011) produced an updated model that predicted the population to increase 19% per year and to attain at least 10,000 females nesting on Mexico beaches by 2011. Approximately 25,000 nests would be needed for an estimate of 10,000 nesters on the beach, based on an average 2.5 nests/nesting female. While counts did not reach 25,000 nests by 2015, it is clear that the population has increased over the long term. The increases in Kemp's ridley sea turtle nesting over the last 2 decades is likely due to a combination of management measures including elimination of direct harvest, nest protection, the use of TEDs, reduced trawling effort in Mexico and the United States, and possibly other changes in vital rates (TEWG 1998; TEWG 2000). While these results are encouraging, the species' limited range as well as low global abundance makes it particularly vulnerable to new sources of mortality as well as demographic and environmental randomness, all factors which are often difficult to predict with any certainty. Additionally, the significant nesting declines observed in 2010 and 2013-2014 potentially indicate a serious population-level impact, and the ongoing recovery trajectory is unclear.

Threats

Kemp's ridley sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (plastics, petroleum products, petrochemicals, etc.), ecosystem alterations (nesting beach development, beach nourishment and shoreline stabilization, vegetation changes, etc.), poaching,

global climate change, fisheries interactions, natural predation, and disease. The remainder of this section will expand on a few of the aforementioned threats and how they may specifically impact Kemp's ridley sea turtles.

As Kemp's ridley sea turtles continue to recover and nesting *arribadas*[5] are increasingly established, bacterial and fungal pathogens in nests are also likely to increase. Bacterial and fungal pathogen impacts have been well documented in the large arribadas of the olive ridley at Nancite in Costa Rica (Mo 1988). In some years, and on some sections of the beach, the hatching success can be as low as 5% (Mo 1988). As the Kemp's ridley nest density at Rancho Nuevo and adjacent beaches continues to increase, appropriate monitoring of emergence success will be necessary to determine if there are any density-dependent effects.

Since 2010, we have documented (via the Sea Turtle Stranding and Salvage Network data, https://www.fisheries.noaa.gov/national/marine-life-distress/sea-turtle-stranding-and-salvage-network) elevated sea turtle strandings in the Northern Gulf of Mexico, particularly throughout the Mississippi Sound area. For example, in the first 3 weeks of June 2010, over 120 sea turtle strandings were reported from Mississippi and Alabama waters, none of which exhibited any signs of external oiling to indicate effects associated with the DWH oil spill event. A total of 644 sea turtle strandings were reported in 2010 from Louisiana, Mississippi, and Alabama waters, 561 (87%) of which were Kemp's ridley sea turtles. During March through May of 2011, 267 sea turtle strandings were reported from Mississippi and Alabama waters alone. A total of 525 sea turtle strandings were reported in 2011 from Louisiana, Mississippi, and Alabama waters, with the majority (455) having occurred from March through July, 390 (86%) of which were Kemp's ridley sea turtles. During 2012, a total of 384 sea turtles were reported from Louisiana, Mississippi, and Alabama waters. Of these reported strandings, 343 (89%) were Kemp's ridley sea turtles. During 2014, a total of 285 sea turtles were reported from Louisiana, Mississippi, and Alabama waters, though the data is incomplete. Of these reported strandings, 229 (80%) were Kemp's ridley sea turtles. These stranding numbers are significantly greater than reported in past years; Louisiana, Mississippi, and Alabama waters reported 42 and 73 sea turtle strandings for 2008 and 2009, respectively. It should be noted that stranding coverage has increased considerably due to the DWH oil spill event.

Nonetheless, considering that strandings typically represent only a small fraction of actual mortality, these stranding events potentially represent a serious impact to the recovery and survival of the local sea turtle populations. While a definitive cause for these strandings has not been identified, necropsy results indicate a significant number of stranded turtles from these events likely perished due to forced submergence, which is commonly associated with fishery interactions (B. Stacy, NMFS, pers. comm. to M. Barnette, NMFS PRD, March 2012). Yet, available information indicates fishery effort was extremely limited during the stranding events. The fact that 80% or more of all Louisiana, Mississippi, and Alabama stranded sea turtles in the past 5 years were Kemp's ridleys is notable; however, this could simply be a function of the species' preference for shallow, inshore waters coupled with increased population abundance, as reflected in recent Kemp's ridley nesting increases.

[5] *Arribada* is the Spanish word for "arrival" and is the term used for massive synchronized nesting within the genus *Lepidochelys.*

In response to these strandings, and due to speculation that fishery interactions may be the cause, fishery observer effort was shifted to evaluate the inshore skimmer trawl fisheries beginning in 2012. During May-July of that year, observers reported 24 sea turtle interactions in the skimmer trawl fisheries. All but a single sea turtle were identified as Kemp's ridleys (1 sea turtle was an unidentified hardshell turtle). Encountered sea turtles were all very small juvenile specimens, ranging from 7.6-19.0 in (19.4-48.3 cm) curved carapace length (CCL). Subsequent years of observation noted additional captures in the skimmer trawl fisheries, including some mortalities. The small average size of encountered Kemp's ridleys introduces a potential conservation issue, as over 50% of these reported sea turtles could potentially pass through the maximum 4-in bar spacing of TEDs currently required in the shrimp fisheries. Due to this issue, a proposed 2012 rule to require 4-in bar spacing TEDs in the skimmer trawl fisheries (77 FR 27411) was not implemented. Following additional gear testing, however, we proposed a new rule in 2016 (81 FR 91097) to require TEDs with 3-inch (in) bar spacing for all vessels using skimmer trawls, pusher-head trawls, or wing nets. Ultimately, we published a final rule on December 20, 2019 (84 FR 70048), that requires all skimmer trawl vessels 40 feet and greater in length to use TEDs designed to exclude small sea turtles in their nets effective April 1, 2021. Given the nesting trends and habitat utilization of Kemp's ridley sea turtles, it is likely that fishery interactions in the Northern Gulf of Mexico may continue to be an issue of concern for the species, and one that may potentially slow the rate of recovery for Kemp's ridley sea turtles.

Here we discuss specific impacts of the DWH oil spill on Kemp's ridley sea turtles. Kemp's ridleys experienced the greatest negative impact stemming from the DWH oil spill of any sea turtle species. Impacts to Kemp's ridley sea turtles occurred to offshore small juveniles, as well as large juveniles and adults. Loss of hatchling production resulting from injury to adult turtles was also estimated for this species. Injuries to adult turtles of other species, such as loggerheads, certainly would have resulted in unrealized nests and hatchlings to those species as well. Yet, the calculation of unrealized nests and hatchlings was limited to Kemp's ridleys for several reasons. All Kemp's ridleys in the Gulf belong to the same population (NMFS et al. 2011), so total population abundance could be calculated based on numbers of hatchlings because all individuals that enter the population could reasonably be expected to inhabit the northern Gulf of Mexico throughout their lives (DWH Trustees 2016).

A total of 217,000 small juvenile Kemp's ridleys (51.5% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. That means approximately half of all small juvenile Kemp's ridleys from the total population estimate of 430,000 oceanic small juveniles were exposed to oil. Furthermore, a large number of small juveniles were removed from the population, as up to 90,300 small juveniles Kemp's ridleys are estimated to have died as a direct result of the exposure. Therefore, as much as 20% of the small oceanic juveniles of this species were killed during that year. Impacts to large juveniles (>3 years old) and adults were also high. An estimated 21,990 such individuals were exposed to oil (about 22% of the total estimated population for those age classes); of those, 3,110 mortalities were estimated (or 3% of the population for those age classes). The loss of near-reproductive and reproductive-stage females would have contributed to some extent to the decline in total nesting abundance observed between 2011 and 2014. The estimated number of unrealized Kemp's ridley nests is between 1,300 and 2,000, which translates to between approximately 65,000 and 95,000 unrealized hatchlings (DWH Trustees 2016). This is a minimum estimate, however, because the

sublethal effects of the DWH oil spill event on turtles, their prey, and their habitats might have delayed or reduced reproduction in subsequent years, which may have contributed substantially to additional nesting deficits observed following the DWH oil spill event. These sublethal effects could have slowed growth and maturation rates, increased remigration intervals, and decreased clutch frequency (number of nests per female per nesting season). The nature of the DWH oil spill event effect on reduced Kemp's ridley nesting abundance and associated hatchling production after 2010 requires further evaluation. It is clear that the DWH oil spill event resulted in large losses to the Kemp's ridley population across various age classes, and likely had an important population-level effect on the species. Still, we do not have a clear understanding of those impacts on the population trajectory for the species into the future.

Green Sea Turtle

The green sea turtle was originally listed as threatened under the ESA on July 28, 1978, except for the Florida and Pacific coast of Mexico breeding populations, which were listed as endangered. On April 6, 2016, the original listing was replaced with the listing of 11 DPSs (81 FR 20057 2016) (Figure 4). The Mediterranean, Central West Pacific, and Central South Pacific DPSs were listed as endangered. The North Atlantic, South Atlantic, Southwest Indian, North Indian, East Indian-West Pacific, Southwest Pacific, Central North Pacific, and East Pacific DPSs were listed as threatened. For the purposes of this consultation, only the South Atlantic DPS (SA DPS) and North Atlantic DPS (NA DPS) will be considered, as they are the only two DPSs with individuals occurring in the Atlantic and Gulf of Mexico waters of the United States.

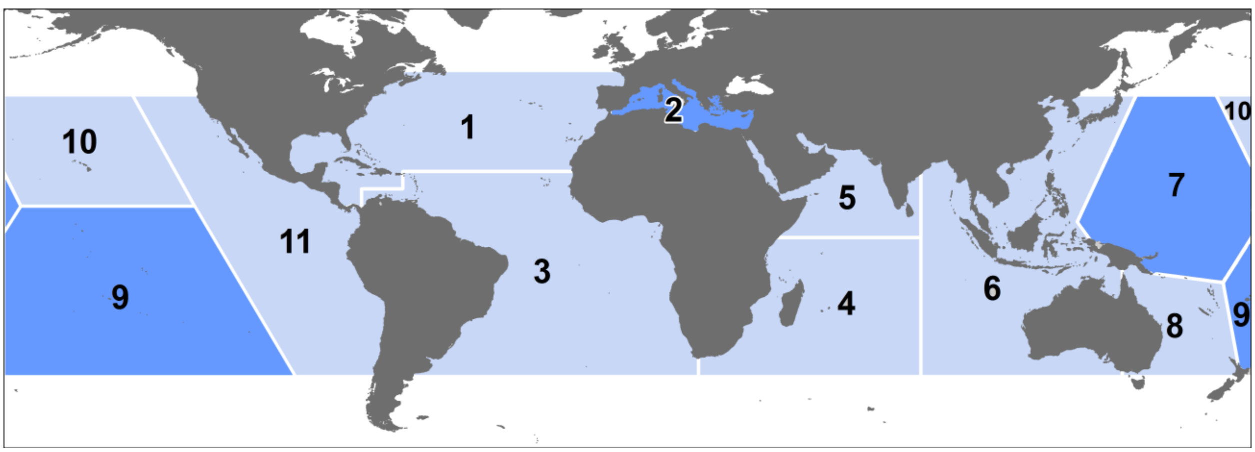

Figure 4. Threatened (light) and endangered (dark) green turtle DPSs: 1. North Atlantic, 2. Mediterranean, 3. South Atlantic, 4. Southwest Indian, 5. North Indian, 6. East Indian-West Pacific, 7. Central West Pacific, 8. Southwest Pacific, 9. Central South Pacific, 10. Central North Pacific, and 11. East Pacific.

Species Description and Distribution

The green sea turtle is the largest of the hardshell marine turtles, growing to a weight of 350 lb (159 kg) with a straight carapace length of greater than 3.3 ft (1 m). Green sea turtles have a smooth carapace with 4 pairs of lateral (or costal) scutes and a single pair of elongated prefrontal scales between the eyes. They typically have a black dorsal surface and a white ventral surface, although the carapace of green sea turtles in the Atlantic Ocean has been known to change in color from solid black to a variety of shades of grey, green, or brown and black in starburst or irregular patterns (Lagueux 2001).

With the exception of post-hatchlings, green sea turtles live in nearshore tropical and subtropical waters where they generally feed on marine algae and seagrasses. They have specific foraging grounds and may make large migrations between these forage sites and natal beaches for nesting (Hays et al. 2001). Green sea turtles nest on sandy beaches of mainland shores, barrier islands, coral islands, and volcanic islands in more than 80 countries worldwide (Hirth 1997). The 2 largest nesting populations are found at Tortuguero, on the Caribbean coast of Costa Rica (part of the NA DPS), and Raine Island, on the Pacific coast of Australia along the Great Barrier Reef.

Differences in mitochondrial DNA properties of green sea turtles from different nesting regions indicate there are genetic subpopulations (Bowen et al. 1992; FitzSimmons et al. 2006). Despite the genetic differences, sea turtles from separate nesting origins are commonly found mixed together on foraging grounds throughout the species' range. Within U.S. waters individuals from both the NA and SA DPSs can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of NA and SA DPS individuals in any given location, two small-scale studies provide an insight into the degree of mixing on the foraging grounds. An analysis of cold-stunned green turtles in St. Joseph Bay, Florida (northern Gulf of Mexico) found approximately 4% of individuals came from nesting stocks in the SA DPS (specifically Suriname, Aves Island, Brazil, Ascension Island, and Guinea Bissau) (Foley et al. 2007). On the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the SA DPS (Bass and Witzell 2000). All of the individuals in both studies were benthic juveniles. Available information on green turtle migratory behavior indicates that long distance dispersal is only seen for juvenile turtles. This suggests that larger adult-sized turtles return to forage within the region of their natal rookeries, thereby limiting the potential for gene flow across larger scales (Monzón-Argüello et al. 2010). While all of the mainland U.S. nesting individuals are part of the NA DPS, the U.S. Caribbean nesting assemblages are split between the NA and SA DPS. Nesters in Puerto Rico are part of the NA DPS, while those in the U.S. Virgin Islands are part of the SA DPS. We do not currently have information on what percent of individuals on the U.S. Caribbean foraging grounds come from which DPS.

North Atlantic DPS Distribution

The NA DPS boundary is illustrated in Figure 1. Four regions support nesting concentrations of particular interest in the NA DPS: Costa Rica (Tortuguero), Mexico (Campeche, Yucatan, and Quintana Roo), U.S. (Florida), and Cuba. By far the most important nesting concentration for green turtles in this DPS is Tortuguero, Costa Rica. Nesting also occurs in the Bahamas, Belize, Cayman Islands, Dominican Republic, Haiti, Honduras, Jamaica, Nicaragua, Panama, Puerto Rico, Turks and Caicos Islands, and North Carolina, South Carolina, Georgia, and Texas, U.S.A. In the eastern North Atlantic, nesting has been reported in Mauritania (Fretey 2001).

The complete nesting range of NA DPS green sea turtles within the southeastern United States includes sandy beaches between Texas and North Carolina, as well as Puerto Rico (Dow et al. 2007; NMFS and USFWS 1991). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Johnson and Ehrhart 1994; Meylan et al. 1995).

Principal U.S. nesting areas for green sea turtles are in eastern Florida, predominantly Brevard south through Broward counties.

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

<u>South Atlantic DPS Distribution</u>

The SA DPS boundary is shown in Figure 1, and includes the U.S. Virgin Islands in the Caribbean. The SA DPS nesting sites can be roughly divided into four regions: western Africa, Ascension Island, Brazil, and the South Atlantic Caribbean (including Colombia, the Guianas, and Aves Island in addition to the numerous small, island nesting sites).

The in-water range of the SA DPS is widespread. In the eastern South Atlantic, significant sea turtle habitats have been identified, including green turtle feeding grounds in Corisco Bay, Equatorial Guinea/Gabon (Formia 1999); Congo; Mussulo Bay, Angola (Carr and Carr 1991); as well as Principe Island. Juvenile and adult green turtles utilize foraging areas throughout the Caribbean areas of the South Atlantic, often resulting in interactions with fisheries occurring in those same waters (Dow et al. 2007). Juvenile green turtles from multiple rookeries also frequently utilize the nearshore waters off Brazil as foraging grounds as evidenced from the frequent captures by fisheries (Lima et al. 2010; López-Barrera et al. 2012; Marcovaldi et al. 2009). Genetic analysis of green turtles on the foraging grounds off Ubatuba and Almofala, Brazil show mixed stocks coming primarily from Ascension, Suriname and Trindade as a secondary source, but also Aves, and even sometimes Costa Rica (North Atlantic DPS)(Naro-Maciel et al. 2007; Naro-Maciel et al. 2012). While no nesting occurs as far south as Uruguay and Argentina, both have important foraging grounds for South Atlantic green turtles (Gonzalez Carman et al. 2011; Lezama 2009; López-Mendilaharsu et al. 2006; Prosdocimi et al. 2012; Rivas-Zinno 2012).

Life History Information
Green sea turtles reproduce sexually, and mating occurs in the waters off nesting beaches and along migratory routes. Mature females return to their natal beaches (i.e., the same beaches where they were born) to lay eggs (Balazs 1982; Frazer and Ehrhart 1985) every 2-4 years while males are known to reproduce every year (Balazs 1983). In the southeastern United States, females generally nest between June and September, and peak nesting occurs in June and July

(Witherington and Ehrhart 1989b). During the nesting season, females nest at approximately 2-week intervals, laying an average of 3-4 clutches (Johnson and Ehrhart 1996). Clutch size often varies among subpopulations, but mean clutch size is approximately 110-115 eggs. In Florida, green sea turtle nests contain an average of 136 eggs (Witherington and Ehrhart 1989b). Eggs incubate for approximately 2 months before hatching. Hatchling green sea turtles are approximately 2 inches (5 cm) in length and weigh approximately 0.9 ounces (25 grams). Survivorship at any particular nesting site is greatly influenced by the level of man-made stressors, with the more pristine and less disturbed nesting sites (e.g., along the Great Barrier Reef in Australia) showing higher survivorship values than nesting sites known to be highly disturbed (e.g., Nicaragua) (Campell and Lagueux 2005; Chaloupka and Limpus 2005).

After emerging from the nest, hatchlings swim to offshore areas and go through a post-hatchling pelagic stage where they are believed to live for several years. During this life stage, green sea turtles feed close to the surface on a variety of marine algae and other life associated with drift lines and debris. This early oceanic phase remains one of the most poorly understood aspects of green sea turtle life history (NMFS and USFWS 2007c). Green sea turtles exhibit particularly slow growth rates of about 0.4-2 inches (1-5 cm) per year (Green 1993), which may be attributed to their largely herbivorous, low-net energy diet (Bjorndal 1982). At approximately 8-10 inches (20-25 cm) carapace length, juveniles leave the pelagic environment and enter nearshore developmental habitats such as protected lagoons and open coastal areas rich in sea grass and marine algae. Growth studies using skeletochronology indicate that green sea turtles in the western Atlantic shift from the oceanic phase to nearshore developmental habitats after approximately 5-6 years (Bresette et al. 2006; Zug and Glor 1998). Within the developmental habitats, juveniles begin the switch to a more herbivorous diet, and by adulthood feed almost exclusively on seagrasses and algae (Rebel 1974), although some populations are known to also feed heavily on invertebrates (Carballo et al. 2002). Green sea turtles mature slowly, requiring 20-50 years to reach sexual maturity (Chaloupka and Musick 1997; Hirth 1997).

While in coastal habitats, green sea turtles exhibit site fidelity to specific foraging and nesting grounds, and it is clear they are capable of “homing in” on these sites if displaced (McMichael et al. 2003). Reproductive migrations of Florida green sea turtles have been identified through flipper tagging and/or satellite telemetry. Based on these studies, the majority of adult female Florida green sea turtles are believed to reside in nearshore foraging areas throughout the Florida Keys and in the waters southwest of Cape Sable, and some post-nesting turtles also reside in Bahamian waters as well (NMFS and USFWS 2007c).

Status and Population Dynamics

Accurate population estimates for marine turtles do not exist because of the difficulty in sampling turtles over their geographic ranges and within their marine environments. Nonetheless, researchers have used nesting data to study trends in reproducing sea turtles over time. A summary of nesting trends and nester abundance is provided in the most recent status review for the species (Seminoff et al. 2015), with information for each of the DPSs.

North Atlantic DPS

The NA DPS is the largest of the 11 green turtle DPSs, with an estimated nester abundance of over 167,000 adult females from 73 nesting sites. Overall this DPS is also the most data rich. Eight of the sites have high levels of abundance (i.e., <1000 nesters), located in Costa Rica, Cuba, Mexico, and Florida. All major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015).

Quintana Roo, Mexico, accounts for approximately 11% of nesting for the DPS (Seminoff et al. 2015). In the early 1980s, approximately 875 nests/year were deposited, but by 2000 this increased to over 1,500 nests/year (NMFS and USFWS 2007c). By 2012, more than 26,000 nests were counted in Quintana Roo (J. Zurita, CIQROO, unpublished data, 2013, in Seminoff et al. 2015).

Tortuguero, Costa Rica is by far the predominant nesting site, accounting for an estimated 79% of nesting for the DPS (Seminoff et al. 2015). Nesting at Tortuguero appears to have been increasing since the 1970's, when monitoring began. For instance, from 1971-1975 there were approximately 41,250 average annual emergences documented and this number increased to an average of 72,200 emergences from 1992-1996 (Bjorndal et al. 1999). Troëng and Rankin (2005) collected nest counts from 1999-2003 and also reported increasing trends in the population consistent with the earlier studies, with nest count data suggesting 17,402-37,290 nesting females per year (NMFS and USFWS 2007c). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Tortuguero, Costa Rica population's growing at 4.9% annually.

In the continental United States, green sea turtle nesting occurs along the Atlantic coast, primarily along the central and southeast coast of Florida (Meylan et al. 1994; Weishampel et al. 2003). Occasional nesting has also been documented along the Gulf Coast of Florida (Meylan et al. 1995). Green sea turtle nesting is documented annually on beaches of North Carolina, South Carolina, and Georgia, though nesting is found in low quantities (up to tens of nests) (nesting databases maintained on www.seaturtle.org).

Florida accounts for approximately 5% of nesting for this DPS (Seminoff et al. 2015). Modeling by Chaloupka et al. (2008) using data sets of 25 years or more resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9% at that time. Increases have been even more rapid in recent years. In Florida, index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green sea turtle nesting has generally shown biennial peaks in abundance with a positive trend during the 10 years of regular monitoring (Figure 5). According to data collected from Florida's index nesting beach survey from 1989-2021, green sea turtle nest counts across Florida have increased dramatically, from a low of 267 in the early 1990s to a high of 40,911 in 2019. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011. The pattern departed from the low lows and high peaks in 2020 and 2021 as

well, when 2020 nesting only dropped by half from the 2019 high, while 2021 nesting only increased by a small amount over the 2020 nesting (Figure 5).

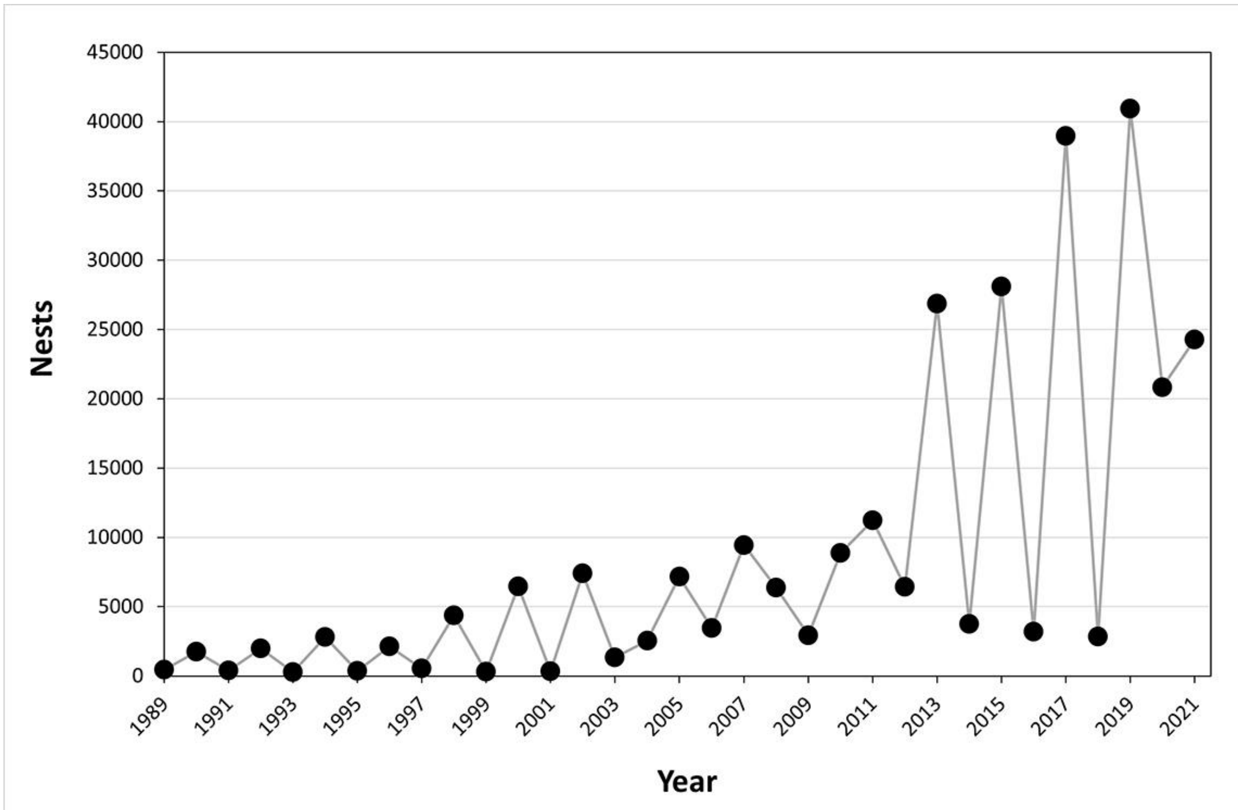

Figure 5. Green sea turtle nesting at Florida index beaches since 1989

Similar to the nesting trend found in Florida, in-water studies in Florida have also recorded increases in green turtle captures at the Indian River Lagoon site, with a 661 percent increase over 24 years (Ehrhart et al. 2007), and the St Lucie Power Plant site, with a significant increase in the annual rate of capture of immature green turtles (SCL<90 cm) from 1977 to 2002 or 26 years (3,557 green turtles total; M. Bressette, Inwater Research Group, unpubl. data; (Witherington et al. 2006).

South Atlantic DPS

The SA DPS is large, estimated at over 63,000 nesters, but data availability is poor. More than half of the 51 identified nesting sites (37) did not have sufficient data to estimate number of nesters or trends (Seminoff et al. 2015). This includes some sites, such as beaches in French Guiana, which are suspected to have large numbers of nesters. Therefore, while the estimated number of nesters may be substantially underestimated, we also do not know the population trends at those data-poor beaches. However, while the lack of data was a concern due to increased uncertainty, the overall trend of the SA DPS was not considered to be a major concern as some of the largest nesting beaches such as Ascension Island (United Kingdom), Aves Island (Venezuela), and Galibi (Suriname) appear to be increasing. Others such as Trindade (Brazil), Atol das Rocas (Brazil), and Poilão (Guinea-Bissau) and the rest of Guinea-Bissau seem to be

stable or do not have sufficient data to make a determination. Bioko (Equatorial Guinea) appears to be in decline but has less nesting than the other primary sites (Seminoff et al. 2015).

In the U.S., nesting of SA DPS green turtles occurs on the beaches of the U.S. Virgin Islands, primarily on Buck Island. There is insufficient data to determine a trend for Buck Island nesting, and it is a smaller rookery, with approximately 63 total nesters utilizing the beach (Seminoff et al. 2015).

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of the species for food and other products. Although intentional take of green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. Green sea turtles also face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease.

In addition to the aforementioned threats, green sea turtles are susceptible to natural mortality from Fibropapillomatosis (FP) disease. FP results in the growth of tumors on soft external tissues (flippers, neck, tail, etc.), the carapace, the eyes, the mouth, and internal organs (gastrointestinal tract, heart, lungs, etc.) of turtles (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). These tumors range in size from 0.04 inches (0.1 cm) to greater than 11.81 inches (30 cm) in diameter and may affect swimming, vision, feeding, and organ function (Aguirre et al. 2002; Herbst 1994; Jacobson et al. 1989). Presently, scientists are unsure of the exact mechanism causing this disease, though it is believed to be related to both an infectious agent, such as a virus (Herbst et al. 1995), and environmental conditions (e.g., habitat degradation, pollution, low wave energy, and shallow water (Foley et al. 2005). FP is cosmopolitan, but it has been found to affect large numbers of animals in specific areas, including Hawaii and Florida (Herbst 1994; Jacobson 1990; Jacobson et al. 1991).

Cold-stunning is another natural threat to green sea turtles. Although it is not considered a major source of mortality in most cases, as temperatures fall below 46.4°-50°F (8°-10°C) turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989a). 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, and hundreds found dead or dying. A large cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,650 green sea turtles found cold-stunned in Texas. Of these, approximately 620 were found dead or died after stranding, while approximately 1,030 turtles were rehabilitated and released. During this same timeframe,

approximately 340 green sea turtles were found cold-stunned in Mexico, though approximately 300 of those were subsequently rehabilitated and released.

Here we discuss specific impacts of the DWH oil spill on green sea turtles. Impacts to green sea turtles occurred to offshore small juveniles only. A total of 154,000 small juvenile greens (36.6% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. A large number of small juveniles were removed from the population, as 57,300 small juveniles greens are estimated to have died as a result of the exposure. A total of 4 nests (580 eggs) were also translocated during response efforts, with 455 hatchlings released (the fate of which is unknown) (DWH Trustees 2015). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources, which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic, and the proportion of the population using the northern Gulf of Mexico at any given time is relatively low. Although it is known that adverse impacts occurred and numbers of animals in the Gulf of Mexico were reduced as a result of the Deepwater Horizon oil spill of 2010 (DWH), the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, as well as the impacts being primarily to smaller juveniles (lower reproductive value than adults and large juveniles), reduces the impact to the overall population. It is unclear what impact these losses may have caused on a population level, but it is not expected to have had a large impact on the population trajectory moving forward. However, recovery of green turtle numbers equivalent to what was lost in the northern Gulf of Mexico as a result of the spill will likely take decades of sustained efforts to reduce the existing threats and enhance survivorship of multiple life stages (DWH Trustees 2015).

Loggerhead Sea Turtle – Northwest Atlantic (NWA) DPS

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

Species Description and Distribution
Loggerheads are large sea turtles. Adults in the southeast United States average about 3 ft (92 cm) long, measured as a straight carapace length, and weigh approximately 255 lb (116 kg) (Ehrhart and Yoder 1978). Adult and subadult loggerhead sea turtles typically have a light

yellow plastron and a reddish brown carapace covered by non-overlapping scutes that meet along seam lines. They typically have 11 or 12 pairs of marginal scutes, 5 pairs of costals, 5 vertebrals, and a nuchal (precentral) scute that is in contact with the first pair of costal scutes (Dodd Jr. 1988).

The loggerhead sea turtle inhabits continental shelf and estuarine environments throughout the temperate and tropical regions of the Atlantic, Pacific, and Indian Oceans (Dodd Jr. 1988). Habitat uses within these areas vary by life stage. Juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd Jr. 1988). Subadult and adult loggerheads are primarily found in coastal waters and eat benthic invertebrates such as mollusks and decapod crustaceans in hard bottom habitats.

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

Non-nesting, adult female loggerheads are reported throughout the U.S. Atlantic, Gulf of Mexico, and Caribbean Sea. Little is known about the distribution of adult males who are seasonally abundant near nesting beaches. Aerial surveys suggest that loggerheads as a whole are distributed in U.S. waters as follows: 54% off the southeast U.S. coast, 29% off the northeast U.S. coast, 12% in the eastern Gulf of Mexico, and 5% in the western Gulf of Mexico (TEWG 1998).

Within the NWA DPS, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf Coast of Florida. Previous Section 7 analyses have recognized at least 5 western Atlantic subpopulations, divided geographically as follows: (1) a Northern nesting subpopulation, occurring from North Carolina to northeast Florida at about 29ºN; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast of the state to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the eastern Yucatán Peninsula, Mexico (Márquez M. 1990; TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001).

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula. It also concluded that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the recovery plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are as follows: (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) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species. Although the recovery plan was written prior to the listing of the NWA DPS, the recovery units for what was then termed the Northwest Atlantic population apply to the NWA DPS.

Life History Information

The Northwest Atlantic Loggerhead Recovery Team defined the following 8 life stages for the loggerhead life cycle, which include the ecosystems those stages generally use: (1) egg (terrestrial zone), (2) hatchling stage (terrestrial zone), (3) hatchling swim frenzy and transitional stage (neritic zone[6]), (4) juvenile stage (oceanic zone), (5) juvenile stage (neritic zone), (6) adult stage (oceanic zone), (7) adult stage (neritic zone), and (8) nesting female (terrestrial zone) (NMFS and USFWS 2008). Loggerheads are long-lived animals. They reach sexual maturity between 20-38 years of age, although age of maturity varies widely among populations (Frazer and Ehrhart 1985; NMFS 2001). The annual mating season occurs from late March to early June, and female turtles lay eggs throughout the summer months. Females deposit an average of 4.1 nests within a nesting season (Murphy and Hopkins 1984), but an individual female only nests every 3.7 years on average (Tucker 2010). Each nest contains an average of 100-126 eggs (Dodd Jr. 1988) which incubate for 42-75 days before hatching (NMFS and USFWS 2008). Loggerhead hatchlings are 1.5-2 inches long and weigh about 0.7 oz (20 g).

As post-hatchlings, loggerheads hatched on U.S. beaches enter the "oceanic juvenile" life stage, migrating offshore and becoming associated with *Sargassum* habitats, driftlines, and other convergence zones (Carr 1986; Conant et al. 2009; Witherington 2002). Oceanic juveniles grow at rates of 1-2 inches (2.9-5.4 cm) per year (Bjorndal et al. 2003; Snover 2002) over a period as long as 7-12 years (Bolten et al. 1998) before moving to more coastal habitats. Studies have suggested that not all loggerhead sea turtles follow the model of circumnavigating the North Atlantic Gyre as pelagic juveniles, followed by permanent settlement into benthic environments (Bolten and Witherington 2003; Laurent et al. 1998). These studies suggest some turtles may either remain in the oceanic habitat in the North Atlantic longer than hypothesized, or they move back and forth between oceanic and coastal habitats interchangeably (Witzell 2002). Stranding records indicate that when immature loggerheads reach 15-24 in (40-60 cm) SCL, they begin to reside in coastal inshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico (Witzell 2002).

After departing the oceanic zone, neritic juvenile loggerheads in the Northwest Atlantic inhabit continental shelf waters from Cape Cod Bay, Massachusetts, south through Florida, the Bahamas, Cuba, and the Gulf of Mexico. Estuarine waters of the United States, including areas such as Long Island Sound, Chesapeake Bay, Pamlico and Core Sounds, Mosquito and Indian River Lagoons, Biscayne Bay, Florida Bay, as well as numerous embayments fringing the Gulf of Mexico, comprise important inshore habitat. Along the Atlantic and Gulf of Mexico shoreline, essentially all shelf waters are inhabited by loggerheads (Conant et al. 2009).

[6] Neritic refers to the nearshore marine environment from the surface to the sea floor where water depths do not exceed 200 meters.

Like juveniles, non-nesting adult loggerheads also use the neritic zone. However, these adult loggerheads do not use the relatively enclosed shallow-water estuarine habitats with limited ocean access as frequently as juveniles. Areas such as Pamlico Sound, North Carolina, and Indian River Lagoon, Florida, are regularly used by juveniles but not by adult loggerheads. Adult loggerheads do tend to use estuarine areas with more open ocean access, such as the Chesapeake Bay in the U.S. mid-Atlantic. Shallow-water habitats with large expanses of open ocean access, such as Florida Bay, provide year-round resident foraging areas for significant numbers of male and female adult loggerheads (Conant et al. 2009).

Offshore, adults primarily inhabit continental shelf waters, from New York south through Florida, The Bahamas, Cuba, and the Gulf of Mexico. Seasonal use of mid-Atlantic shelf waters, especially offshore New Jersey, Delaware, and Virginia during summer months, and offshore shelf waters, such as Onslow Bay (off the North Carolina coast), during winter months has also been documented (Hawkes et al. 2007)Georgia Department of Natural Resources [GADNR], unpublished data; South Carolina Department of Natural Resources [SCDNR], unpublished data). Satellite telemetry has identified the shelf waters along the west Florida coast, the Bahamas, Cuba, and the Yucatán Peninsula as important resident areas for adult female loggerheads that nest in Florida (Foley et al. 2008; Girard et al. 2009; Hart et al. 2012). The southern edge of the Grand Bahama Bank is important habitat for loggerheads nesting on the Cay Sal Bank in the Bahamas, but nesting females are also resident in the bights of Eleuthera, Long Island, and Ragged Islands. They also reside in Florida Bay in the United States, and along the north coast of Cuba (A. Bolten and K. Bjorndal, University of Florida, unpublished data). Moncada et al. (2010) report the recapture of 5 adult female loggerheads in Cuban waters originally flipper-tagged in Quintana Roo, Mexico, which indicates that Cuban shelf waters likely also provide foraging habitat for adult females that nest in Mexico.

Status and Population Dynamics

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

Numbers of nests and nesting females can vary widely from year to year. Nesting beach surveys, though, can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of female loggerhead sea turtles, as long as such studies are sufficiently long and survey effort and methods are standardized (e.g., NMFS and USFWS 2008). NMFS and USFWS (2008) concluded that the lack of change in 2 important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population.

<u>Peninsular Florida Recovery Unit</u>

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed an average of 64,513 loggerhead nests per year,

representing approximately 15,735 nesting females per year (NMFS and USFWS 2008). The statewide estimated total for 2020 was 105,164 nests (FWRI nesting database).

In addition to the total nest count estimates, the Florida Fish and Wildlife Research Institute (FWRI) uses an index nesting beach survey method. The index survey uses standardized data-collection criteria to measure seasonal nesting and allow accurate comparisons between beaches and between years. FWRI uses the standardized index survey data to analyze the nesting trends (Figure 6) (https://myfwc.com/research/wildlife/sea-turtles/nesting/beach-survey-totals/). Since the beginning of the index program in 1989, 3 distinct trends were identified. From 1989-1998, there was a 24% increase that was followed by a sharp decline over the subsequent 9 years. A large increase in loggerhead nesting has occurred since, as indicated by the 71% increase in nesting over the 10-year period from 2007 and 2016. Nesting in 2016 also represented a new record for loggerheads on the core index beaches. While nest numbers subsequently declined from the 2016 high FWRI noted that the 2007-2021 period represents a period of increase. FWRI examined the trend from the 1998 nesting high through 2016 and found that the decade-long post-1998 decline was replaced with a slight but non-significant increasing trend. Looking at the data from 1989 through 2016, FWRI concluded that there was an overall positive change in the nest counts although it was not statistically significant due to the wide variability between 2012-2016 resulting in widening confidence intervals. Nesting at the core index beaches declined in 2017 to 48,033, and rose again each year through 2020, reaching 53,443 nests before dipping back to 49,100 in 2021. It is important to note that with the wide confidence intervals and uncertainty around the variability in nesting parameters (changes and variability in nests/female, nesting intervals, etc.) it is unclear whether the nesting trend equates to an increase in the population or nesting females over that time frame (Ceriani, et al. 2019).

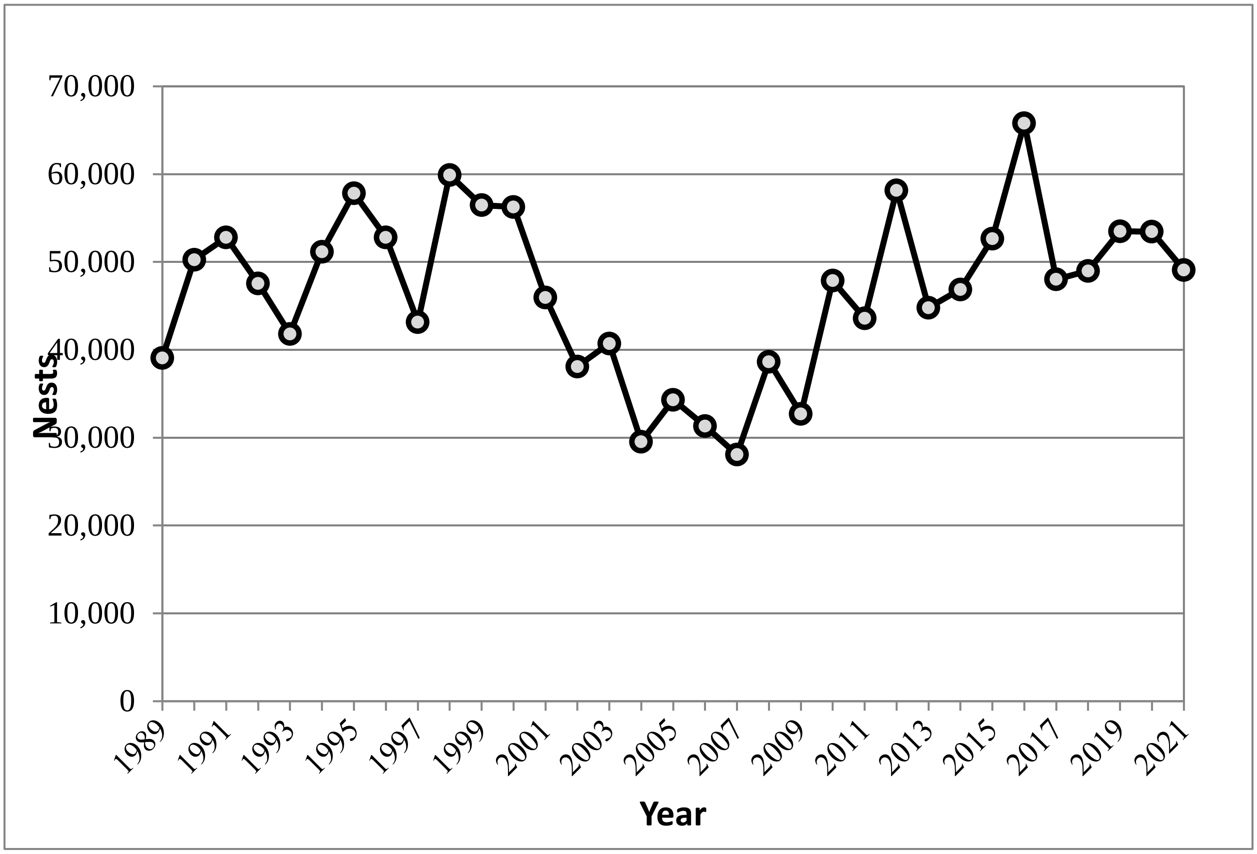

Figure 6. Loggerhead sea turtle nesting at Florida index beaches since 1989

Northern Recovery Unit

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

Data since that analysis (Table 3) are showing improved nesting numbers and a departure from the declining trend. Georgia nesting has rebounded to show the first statistically significant increasing trend since comprehensive nesting surveys began in 1989 (Mark Dodd, GADNR press release, https://georgiawildlife.com/loggerhead-nest-season-begins-where-monitoring-began). South Carolina and North Carolina nesting have also begun to shift away from the past declining trend. Loggerhead nesting in Georgia, South Carolina, and North Carolina all broke records in 2015 and then topped those records again in 2016. Nesting in 2017 and 2018 declined relative to 2016, back to levels seen in 2013 to 2015, but then bounced back in 2019, breaking records for each of the three states and the overall recovery unit. Nesting in 2020 and 2021 declined from the

2019 records, but still remained high, representing the third and fourth highest total numbers for the NRU since 2008.

Table 3. Total Number of NRU Loggerhead Nests (GADNR, SCDNR, and NCWRC nesting datasets compiled at Seaturtle.org)

	Nests Recorded			
Year	**Georgia**	**South Carolina**	**North Carolina**	**Totals**
2008	1,649	4,500	841	**6,990**
2009	998	2,182	302	**3,472**
2010	1,760	3,141	856	**5,757**
2011	1,992	4,015	950	**6,957**
2012	2,241	4,615	1,074	**7,930**
2013	2,289	5,193	1,260	**8,742**
2014	1,196	2,083	542	**3,821**
2015	2,319	5,104	1,254	**8,677**
2016	3,265	6,443	1,612	**11,320**
2017	2,155	5,232	1,195	**8,582**
2018	1,735	2,762	765	**5,262**
2019	3,945	8,774	2,291	**15,010**
2020	2,786	5,551	1,335	**9,672**
2021	2,493	5,639	1,448	**9,580**

South Carolina also conducts an index beach nesting survey similar to the one described for Florida. Although the survey only includes a subset of nesting, the standardized effort and locations allow for a better representation of the nesting trend over time. Increases in nesting were seen for the period from 2009-2013, with a subsequent steep drop in 2014. Nesting then rebounded in 2015 and 2016, setting new highs each of those years. Nesting in 2017 dropped back down from the 2016 high, but was still the second highest on record. After another drop in 2018, a new record was set for the 2019 season, with a return to 2016 levels in 2020 and 2021 (Figure 7).

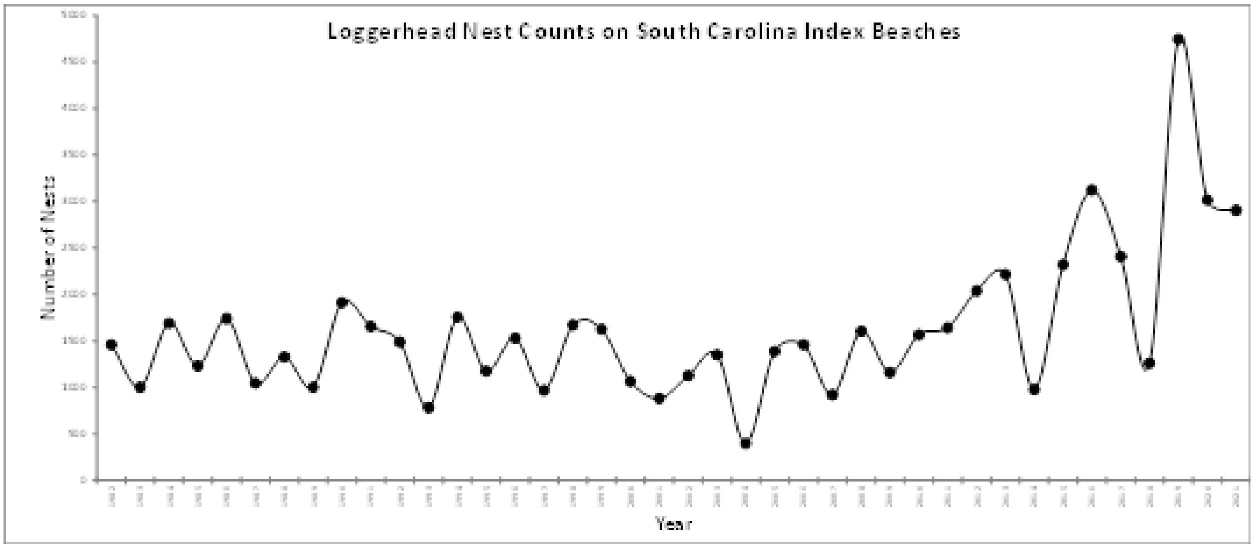

Figure 7. South Carolina index nesting beach counts for loggerhead sea turtles (from the SCDNR website: https://www.dnr.sc.gov/seaturtle/ibs.htm)

<u>Other Northwest Atlantic DPS Recovery Units</u>
The remaining 3 recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages, but they are still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort was relatively stable during the 9-year period from 1995-2004, although the 2002 year was missed. Nest counts ranged from 168-270, with a mean of 246, but there was no detectable trend during this period (NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. Analysis of the 12-year dataset (1997-2008) of index nesting beaches in the area shows a statistically significant declining trend of 4.7% annually. Nesting on the Florida Panhandle index beaches, which represents the majority of NGMRU nesting, had shown a large increase in 2008, but then declined again in 2009 and 2010 before rising back to a level similar to the 2003-2007 average in 2011. From 1989-2018 the average number of NGMRU nests annually on index beaches was 169 nests, with an average of 1100 counted in the statewide nesting counts (Ceriani et al. 2019). Nesting survey effort has been inconsistent among the GCRU nesting beaches, and no trend can be determined for this subpopulation (NMFS and USFWS 2008). Zurita et al. (2003) found a statistically significant increase in the number of nests on 7 of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. Nonetheless, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

<u>In-water Trends</u>
Nesting data are the best current indicator of sea turtle population trends, but in-water data also provide some insight. In-water research suggests the abundance of neritic juvenile loggerheads is steady or increasing. Although Ehrhart et al. (2007) found no significant regression-line trend in a long-term dataset, researchers have observed notable increases in catch per unit effort (CPUE) (Arendt et al. 2009; Ehrhart et al. 2007; Epperly et al. 2007). Researchers believe that this

increase in CPUE is likely linked to an increase in juvenile abundance, although it is unclear whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence. Bjorndal et al. (2005), cited in NMFS and USFWS (2008), caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest oceanic/neritic juveniles (historically referred to as small benthic juveniles), which could indicate a relatively large number of individuals around the same age may mature in the near future (TEWG 2009). In-water studies throughout the eastern United States, however, indicate a substantial decrease in the abundance of the smallest oceanic/neritic juvenile loggerheads, a pattern corroborated by stranding data (TEWG 2009).

Population Estimate

The NMFS Southeast Fisheries Science Center developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS-SEFSC 2009). The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Resulting trajectories of model runs for each individual recovery unit, and the western North Atlantic population as a whole, were found to be very similar. The model run estimates from the adult female population size for the western North Atlantic (from the 2004-2008 time frame), suggest the adult female population size is approximately 20,000-40,000 individuals, with a low likelihood of females' numbering up to 70,000 (NMFS-SEFSC 2009). A less robust estimate for total benthic females in the western North Atlantic was also obtained, yielding approximately 30,000-300,000 individuals, up to less than 1 million (NMFS-SEFSC 2009). A preliminary regional abundance survey of loggerheads within the northwestern Atlantic continental shelf for positively identified loggerhead in all strata estimated about 588,000 loggerheads (interquartile range of 382,000-817,000). When correcting for unidentified turtles in proportion to the ratio of identified turtles, the estimate increased to about 801,000 loggerheads (interquartile range of 521,000-1,111,000) (NMFS-NEFSC 2011).

Threats

Loggerhead sea turtles face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, oceanic events such as cold-stunning, pollution (e.g., plastics, petroleum products, petrochemicals), ecosystem alterations (e.g., nesting beach development, beach nourishment and shoreline stabilization, vegetation changes), poaching, global climate change, fisheries interactions, natural predation, and disease. The impact of fishery interactions is a point of further emphasis for this species. The joint NMFS and USFWS Loggerhead Biological Review Team determined that the greatest threats to the NWA DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant et al. 2009).

Regarding the impacts of pollution, loggerheads may be particularly affected by organochlorine contaminants; they have the highest organochlorine concentrations (Storelli et al. 2008) and metal loads (D'Ilio et al. 2011) in sampled tissues among the sea turtle species. It is thought that dietary preferences were likely to be the main differentiating factor among sea turtle species.

Storelli et al. (2008) analyzed tissues from stranded loggerhead sea turtles and found that mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals, and porpoises (Law et al. 1991).

Here we discuss specific impacts of the DWH oil spill on loggerhead sea turtles. Impacts to loggerhead sea turtles occurred to offshore small juveniles as well as large juveniles and adults. A total of 30,800 small juvenile loggerheads (7.3% of the total small juvenile sea turtle exposures to oil from the spill) were estimated to have been exposed to oil. Of those exposed, 10,700 small juveniles are estimated to have died as a result of the exposure. In contrast to small juveniles, loggerheads represented a large proportion of the adults and large juveniles exposed to and killed by the oil. There were 30,000 exposures (almost 52% of all exposures for those age/size classes) and 3,600 estimated mortalities. A total of 265 nests (27,618 eggs) were also translocated during response efforts, with 14,216 hatchlings released, the fate of which is unknown (DWH Trustees 2016). Additional unquantified effects may have included inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

Unlike Kemp's ridleys, the majority of nesting for the NWA DPS occurs on the Atlantic coast and, thus, loggerheads were impacted to a relatively lesser degree. However, it is likely that impacts to the NGMRU of the NWA DPS would be proportionally much greater than the impacts occurring to other recovery units. Impacts to nesting and oiling effects on a large proportion of the NGMRU recovery unit, especially mating and nesting adults likely had an impact on the NGMRU. Based on the response injury evaluations for Florida Panhandle and Alabama nesting beaches (which fall under the NFMRU), the DWH Trustees (2016) estimated that approximately 20,000 loggerhead hatchlings were lost due to DWH oil spill response activities on nesting beaches. Although the long-term effects remain unknown, the DWH oil spill event impacts to the Northern Gulf of Mexico Recovery Unit may result in some nesting declines in the future due to a large reduction of oceanic age classes during the DWH oil spill event. Although adverse impacts occurred to loggerheads, the proportion of the population that is expected to have been exposed to and directly impacted by the DWH oil spill event is relatively low. Thus we do not believe a population-level impact occurred due to the widespread distribution and nesting location outside of the Gulf of Mexico for this species.

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

Smalltooth Sawfish
The U.S. DPS of smalltooth sawfish was listed as endangered under the ESA effective May 1, 2003 (68 FR 15674; April 1, 2003).

Species Description and Distribution
The smalltooth sawfish is a tropical marine and estuarine elasmobranch. It is a batoid with a long, narrow, flattened, rostral blade (rostrum) lined with a series of transverse teeth along either edge. In general, smalltooth sawfish inhabit shallow coastal waters of the Atlantic Ocean (Dulvy et al. 2016) and feed on a variety of fish (e.g., mullet, jacks, and ladyfish) (Poulakis et al. 2017; Simpfendorfer 2001).

Although this species is reported throughout the tropical Atlantic, NMFS identified smalltooth sawfish from the Southeast U.S. 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 U.S., smalltooth sawfish have historically been captured in estuarine and coastal waters from North Carolina southward through Texas, although peninsular Florida has been the region of the U.S. with the largest number of recorded captures (NMFS 2018). Recent records indicate there is a resident reproducing population of smalltooth sawfish in south and southwest Florida from Charlotte Harbor through the Florida Keys, which is also the last U.S. stronghold for the species (Poulakis and Seitz 2004; Seitz and Poulakis 2002; Simpfendorfer and Wiley 2005). Water temperatures (no lower than 8-12°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 juveniles or adults (over 10 ft) that likely represent seasonal migrants, wanderers, or colonizers from a historical Florida core population to the south, rather than being members of a continuous, even-density population (Bigelow and Schroeder 1953).

Life History Information
Smalltooth sawfish mate in the spring and early summer (Grubbs unpubl. data; Poulakis unpubl. data). Fertilization is internal and females give birth to live young. Evidence suggests a gestation period of approximately 12 months and females produce litters of 7-14 young (Feldheim et al. 2017) (Gelsleichter unpub. data). Females have a biennial reproductive cycle (Feldheim et al. 2017) and parturition (act of giving birth) occurs nearly year round - peaking in spring and early summer (March – July) (Poulakis et al. 2011) (Carlson unpubl. data).

Smalltooth sawfish are approximately 26-31 in (64-80 cm) at birth (Bethea et al. 2012; Poulakis et al. 2011) and may grow to a maximum length of approximately 16 ft (500 cm) (Grubbs unpubl. data) (Brame et al. 2019). Simpfendorfer et al. (2008) report rapid juvenile growth for smalltooth sawfish for the first 2 years after birth, with stretched total length increasing 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. Uncertainty remains in estimating post-juvenile growth rates and age at maturity; yet, recent advances indicate maturity at 7-11 years (Carlson and Simpfendorfer 2015) at lengths of approximately 340 cm for males and 350-370 cm for females (Gelsleichter unpub data).

There are distinct differences in habitat use based on life history stage as the species shifts use through ontogeny. Juvenile smalltooth sawfish, less than 220 cm, inhabit the shallow euryhaline waters (i.e., variable salinity) of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers (NMFS 2000). These juveniles are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves, *Rhizophora mangle* (Hollensead et al. 2016; Hollensead et al. 2018; Poulakis et al. 2011; Poulakis et al. 2013; Simpfendorfer 2001; Simpfendorfer 2003; Simpfendorfer et al. 2010). Simpfendorfer et al. (2010) indicated the smallest juveniles (young-of-the-year juveniles measuring < 100 cm in length) generally used the shallowest water [depths less than 0.5 m (1.64 ft)], had small home ranges (4,264-4,557 m^2), and exhibited high levels of site fidelity. Although small juveniles exhibit high levels of site fidelity for specific nursery habitats for periods of time lasting up to 3 months (Wiley and Simpfendorfer 2007), they do undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide to within red mangrove prop roots at higher tides (Simpfendorfer et al. 2010)—behavior likely to reduce the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer et al. 2010; Simpfendorfer et al. 2011), eventually moving to more offshore habitats where they likely feed on larger prey as they continue to mature.

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 (within or between year) capture rates during random sampling events within the estuary (Poulakis et al. 2011; Poulakis 2012). These high-use areas were termed “hotspots” and also correspond with areas where public encounters are most frequently reported. Use of these “hotspots” can vary within and among years based on the amount and timing of freshwater inflow. Juvenile 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, researchers are unsure what specific biotic or abiotic factors influence this habitat use, but they believe 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).

The juvenile “hotspots” may be of further significance following the findings of female philopatry (Feldheim et al. 2017). More specifically, Feldheim et al. (2017) found that female sawfish return to the same parturition (birthing) sites over multiple years (parturition site fidelity). NMFS expects that these parturition sites align closely with the juvenile “hotspots” given the high fidelity shown by the smallest size/age classes of sawfish to specific nursery areas. Therefore, disturbance of these nursery areas could have wide-ranging effects on the sawfish population if it were to disrupt future parturition.

While adult smalltooth sawfish may also use the estuarine habitats used by juveniles, they are commonly observed in deeper waters along the coasts. Poulakis and Seitz (2004) noted that 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. Similarly, Simpfendorfer and Wiley (2005) reported encounters in deeper waters off the Florida Keys, and observations from both commercial longline fishing vessels and fishery-independent sampling in the Florida Straits

report large smalltooth sawfish in depths up to 130 ft (~40 m)(ISED 2014). Yet, current field studies show adult smalltooth sawfish also use shallow estuarine habitats within Florida Bay and the Everglades (Grubbs unpub. data). Further, NMFS expects that females return to shallow estuaries during parturition (when adult females return to shallow estuaries to give birth).

Status and Population Dynamics
Based on the contraction of the species' geographic range, we expect that the population is a fraction of its historical size. However, few long-term abundance data exist for the smalltooth sawfish, making it very difficult to estimate the current population size. Despite the lack of scientific data, recent encounters with young-of-the-year, older juveniles, and sexually mature smalltooth sawfish indicate that the U.S. population is currently reproducing (Feldheim et al. 2017; Seitz and Poulakis 2002; Simpfendorfer 2003). The abundance of juveniles publically encountered by anglers and boaters, including very small individuals, suggests that the population remains viable (Simpfendorfer and Wiley 2004), and data analyzed from Everglades National Park (ENP) as part of an established fisheries-dependent monitoring program (angler interviews) indicated a slightly increasing trend in juvenile abundance within the park over the past decade (Carlson and Osborne 2012; Carlson et al. 2007). Similarly, preliminary results of juvenile smalltooth sawfish sampling programs in both ENP and Charlotte Harbor indicate the juvenile population is at least stable and possibly increasing (Poulakis unpubl. data, Carlson unpubl. data).

Using a demographic approach and life history data for smalltooth sawfish and similar species from the literature, (Simpfendorfer 2000) estimated intrinsic rates of natural population increase for the species at 0.08-0.13 per year and population doubling times from 5.4-8.5 years. These low intrinsic rates[7] of population increase, suggest that the species is particularly vulnerable to excessive mortality and rapid population declines, after which recovery may take decades. Carlson and Simpfendorfer (2015) constructed an age-structured Leslie matrix model for the U.S. population of smalltooth sawfish, using updated life history information, to determine the species' ability to recover under scenarios of variable life history inputs and the effects of bycatch mortality and catastrophes. As expected, population growth was highest (λ=1.237 yr-1) when age-at-maturity was 7 years and decreased to 1.150 yr-1 when age-at-maturity was 11 years. Despite a high level of variability throughout the model runs, in the absence of fishing mortality or catastrophic climate effects, the population grew at a relatively rapid rate approaching carrying capacity in 40 years when the initial population was set at 2,250 females or 50 years with an initial population of 600 females. Carlson and Simpfendorfer (2015) concluded that smalltooth sawfish in U.S. waters appear to have the ability to recover within the foreseeable future based on a model relying upon optimistic estimates of population size, lower age-at-maturity and the lower level of fisheries-related mortality. Another analysis was less optimistic based on lower estimates of breeding females in the Caloosahatchee River nursery (Chapman unpubl. data). Assuming similar numbers of females among the 5 known nurseries, that study would suggest an initial breeding population of only 140-390 females, essentially half of the initial population considered by Carlson and Simpfendorfer (2015). A smaller initial breeding population would extend the time to reach carrying capacity.

[7] The rate at which a population increases in size if there are no density-dependent forces regulating the population

Threats

Past literature indicates 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 these 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).

<u>Bycatch Mortality</u>

Bycatch mortality is cited as the primary cause for the decline in smalltooth sawfish in the U.S. (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 (NMFS 2009). This has historically been reported in Florida (Snelson and Williams 1981), Louisiana (Simpfendorfer 2002), and Texas (Baughman 1943). For instance, one fisherman interviewed by Evermann and Bean (1897) reported taking an estimated 300 smalltooth sawfish in just one netting season in the Indian River Lagoon, Florida. 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. The Florida net ban passed in 1995 has 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"[8] (Florida Constitution, Article 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 suggest 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 anglers. Encounter data (ISED 2014) and past research (Caldwell 1990) document that rostra are sometimes removed from smalltooth sawfish caught by recreational anglers, thereby reducing their chances of survival. While the current threat of mortality associated with recreational fisheries is expected to be low given that possession of the species in Florida has been prohibited since 1992, bycatch in recreational fisheries remains a potential threat to the species.

<u>Habitat Loss</u>

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

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[8] "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.

were modified or lost between the mid-1970s and mid-1980s within the U.S. (Dahl and 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 U.S., of which approximately 2,450 acres were intertidal wetlands consisting of mangroves or other estuarine shrubs (Steadman and Dahl 2008). Further, Orlando et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 mi of navigation channels and 9,844 mi of shoreline with modifications. 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 the temperature, salinity, and nutrient regimes; reduced both wetlands and submerged aquatic vegetation; and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Reddering 1988; Whitfield and Bruton 1989). While these modifications of habitat are not the primary reason for the decline of smalltooth sawfish abundance, it is likely a contributing factor and almost certainly hampers the recovery of the species. Juvenile sawfish and their nursery habitats are particularly likely to be affected by these kinds of habitat losses or alternations, due to their affinity for shallow, estuarine systems. Prohaska et al. (2018) showed that juvenile smalltooth sawfish within the anthropogenically-altered Charlotte Harbor estuary have higher metabolic stress compared to those collected from more pristine nurseries in the Everglades. 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.

<u>Life History Limitations</u>
The smalltooth sawfish is also limited by its life history characteristics as a relatively slow-growing, 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 (Musick 1999) that make it slow to recover from any significant population decline (Simpfendorfer 2000).

<u>Stochastic Events</u>
Although stochastic events such as aperiodic extreme weather and harmful algal blooms are expected to affect smalltooth, we are currently unsure of their impact. A strong and prolonged cold weather event in January 2010 resulted in the mortality of at least 15 juvenile and 1 adult sawfish (Poulakis et al. 2011; Scharer et al. 2012), and led to far fewer catches in directed research throughout the remainder of the year (Bethea et al. 2011). Another less severe cold front in 2011 did not result in any known mortality but did alter the typical habitat use patterns of juvenile sawfish within the Caloosahatchee River. Since surveys began, 2 hurricanes have made direct landfall within the core range of the U.S. DPS of smalltooth sawfish. While these storms denuded mangroves along the shoreline and created hypoxic water conditions, we are unaware of any direct effects to sawfish. Just prior to the passage of the most recent hurricane (Hurricane Irma), acoustically tagged sawfish moved away from their normal shallow nurseries and then returned within a few days (Poulakis unpubl. data; Carlson unpubl. data). Harmful algal blooms have occurred within the core range of smalltooth sawfish and affected a variety of fauna

including sea turtles, fish, and marine mammals, but to date no sawfish mortalities have been reported.

Current Threats

The 3 major factors that led to the current status of the U.S. DPS of smalltooth sawfish – bycatch mortality, habitat loss, and life history limitations – continue to be the greatest threats today. Other 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). 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 the habitats they use. The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal and its impacts to coastal resources may be significant (IPCC 2007; IPCC 2013). Some of the likely effects commonly mentioned 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 2012; NOAA 2012). The impacts to smalltooth sawfish cannot, for the most part, currently be predicted with any degree of certainty, but we can project some effects to the coastal habitats where they reside. Red mangroves and shallow, euryhaline waters will be directly impacted by climate change through sea level rise, which is expected to increase 0.45 to 0.75 m by 2100 (IPCC 2013). Sea level rise will impact mangrove resources, as sediment surface elevations for mangroves will not 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). Furthermore, the changes in precipitation, coupled with sea level rise, may also alter salinities of coastal habitats, thereby reducing the amount of available smalltooth sawfish nursery habitat.

Giant Manta Ray

NMFS listed the giant manta ray (*Manta birostris*) as threatened under the ESA (83 FR 2916, Publication Date January 22, 2018) and determined that the designation of critical habitat is not prudent (84 FR 66652, Publication Date December 5, 2019). On December 4, 2019, NMFS published a recovery outline for the giant manta ray (NMFS 2019), which serves as an interim guidance to direct recovery efforts for giant manta ray.

Species Description and Distribution

The giant manta ray is the largest living ray, with a wingspan reaching a width of up to 7 m (23 ft), and an average size between 4-5 m (15-16.5 ft). The giant manta ray is recognized by its large diamond-shaped body with elongated wing-like pectoral fins, ventrally placed gill slits, laterally placed eyes, and wide terminal mouth. In front of the mouth, it has 2 structures called cephalic lobes that extend and help to introduce water into the mouth for feeding activities (making them the only vertebrate animals with 3 paired appendages). Giant manta rays have 2 distinct color types: chevron (mostly black back dorsal side and white ventral side) and black (almost completely black on both ventral and dorsal sides). Most of the chevron variants have a black dorsal surface and a white ventral surface with distinct patterns on the underside that can

be used to identify individuals (Miller and Klimovich 2017). There are bright white shoulder markings on the dorsal side that form 2 mirror image right-angle triangles, creating a T-shape on the upper shoulders.

The giant manta ray is found worldwide in tropical and subtropical oceans and in productive coastal areas. They also occasionally occur within estuaries (e.g., lagoons and bays) and Intracostal Waterways (ICWW). In terms of range, within the Northern hemisphere, the species has been documented as far north as southern California and New Jersey on the United States west and east coasts, respectively, and Mutsu Bay, Aomori, Japan, the Sinai Peninsula and Arabian Sea, Egypt, and the Azores Islands (CITES 2013; Gudger 1922; Kashiwagi et al. 2010; Moore 2012). In the Southern Hemisphere, the species occurs as far south as Peru, Uruguay, South Africa, New Zealand and French Polynesia (CITES 2013; Mourier 2012). Within its range, the giant manta ray inhabits tropical, subtropical, and temperate bodies of water and is commonly found offshore, in oceanic waters, and near productive coastlines (Figure) (Kashiwagi et al. 2011; Marshall et al. 2009).

Figure 8. The Extent of Occurrence (dark blue) and Area of Occupancy (light blue) for giant manta rays based on species distribution (Lawson et al. 2017).

Life History Information
Giant manta rays make seasonal long-distance migrations, aggregate in certain areas and remain resident, or aggregate seasonally (Dewar et al. 2008; Girondot et al. 2015; Graham et al. 2012; Stewart et al. 2016). The giant manta ray is a seasonal visitor along productive coastlines with regular upwelling, in oceanic island groups, and at offshore pinnacles and seamounts. The timing of these visits varies by region and seems to correspond with the movement of zooplankton, current circulation and tidal patterns, seasonal upwelling, seawater temperature, and possibly mating behavior. They have also been observed in estuarine waters inlets, with use of these waters as potential nursery grounds (J. Pate, Florida Manta Project, unpublished data; Adams and Amesbury 1998; Medeiros et al. 2015; Milessi and Oddone 2003).

Giant manta rays are known to aggregate in various locations around the world in groups usually ranging from 100-1,000 (Graham et al. 2012; Notarbartolo di Sciara and Hillyer 1989; Venables 2013). These sites function as feeding sites, cleaning stations, or sites where courtship

interactions take place (Graham et al. 2012; Heinrichs et al. 2011; Venables 2013). The appearance of giant manta rays in these locations is generally predictable. For example, food availability due to high productivity events tends to play a significant role in feeding site aggregations (Heinrichs et al. 2011; Notarbartolo di Sciara and Hillyer 1989). Giant manta rays have also been shown to return to a preferred site of feeding or cleaning over extended periods of time (Dewar et al. 2008; Graham et al. 2012; Medeiros et al. 2015). In addition, giant and reef manta rays in Keauhou and Ho'ona Bays in Hawaii, appear to exhibit learned behavior. These manta rays learned to associate artificially lighting with high plankton concertation (primary food source) and shifted foraging strategies to include sites that had artificially lighting at night (Clark 2010). While little is known about giant manta ray aggregation sites, the Flower Garden Banks National Marine Sanctuary and the surrounding region might represent the first documented nursery habitat for giant manta ray (Stewart et al. 2018). Stewart et al. (2018) found that the Flower Garden Banks National Marine Sanctuary provides nursery habitat for juvenile giant manta rays because small age classes have been observed consistently across years at both the population and individual level. The Flower Garden Banks National Marine Sanctuary may be an optimal nursery ground because of its location near the edge of the continental shelf and proximity to abundant pelagic food resources. In addition, small juveniles are frequently observed along a portion of Florida's east coast, indicating that this area may also function as a nursery ground for juvenile giant manta rays. Since directed visual surveys began in 2016, juvenile giant manta rays are regularly observed in the shallow waters (less than 5 m depth) from Jupiter Inlet to Boynton Beach Inlet (J Pate, Florida Manta Project, unpublished data). However, the extent of this purported nursery ground is unknown as the survey area is limited to a relatively narrow geographic area along Florida's southeast coast.

The giant manta ray appears to exhibit a high degree of plasticity in terms of its use of depths within its habitat. Tagging studies have shown that the giant manta rays conduct night descents from 200-450m depths (Rubin et al. 2008; Stewart et al. 2016) and are capable of diving to depths exceeding 1,000 m (A. Marshall et al. unpublished data 2011, cited in Marshall et al. (2011)). Stewart et al. (2016) found diving behavior may be influenced by season, and more specifically, shifts in prey location associated with the thermocline, with tagged giant manta rays (n=4) observed spending a greater proportion of time at the surface from April to June and in deeper waters from August to September. Overall, studies indicate that giant manta rays have a more complex depth profile of their foraging habitat than previously thought, and may actually be supplementing their diet with the observed opportunistic feeding in near-surface waters (Burgess et al. 2016; Couturier et al. 2013).

Giant manta rays primarily feed on planktonic organisms such as euphausiids, copepods, mysids, decapod larvae and shrimp, but some studies have noted their consumption of small and moderately sized fishes (Miller and Klimovich 2017). While it was previously assumed, based on field observations, that giant manta rays feed predominantly during the day on surface zooplankton, results from recent studies (Burgess et al. 2016; Couturier et al. 2013) indicate that these feeding events are not an important source of the dietary intake. When feeding, giant manta rays hold their cephalic lobes in an "O" shape and open their mouth wide, which creates a funnel that pushes water and prey through their mouth and over their gill rakers. They use many different types of feeding strategies, such as barrel rolling (doing somersaults repeatedly) and creating feeding chains with other mantas to maximize prey intake.

The giant manta ray is viviparous (i.e., gives birth to live young). They are slow to mature and have very low fecundity and typically give birth to only one pup every 2 to 3 years. Gestation lasts approximately 10-14 months. Females are only able to produce between 5 and 15 pups in a lifetime (CITES 2013; Miller and Klimovich 2017). The giant manta ray has one of the lowest maximum population growth rates of all elasmobranchs (Dulvy et al. 2014; Miller and Klimovich 2017). The giant manta rays generation time (based on *M. alfredi* life history parameters) is estimated to be 25 years (Miller and Klimovich 2017).

Although giant manta rays have been reported to live at least 40 years, not much is known about their growth and development. Maturity is thought to occur between 8-10 years of age (Miller and Klimovich 2017). Males are estimated to mature at around 3.8 m disc width (slightly smaller than females) and females at 4.5 m disc width (Rambahiniarison et al. 2018).

Status and Population Dynamics

There are no current or historical estimates of global abundance of giant manta rays, with most estimates of subpopulations based on anecdotal observations. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES 2013) found that only ten populations of giant manta rays had been actively studied, 25 other aggregations have been anecdotally identified, all other sightings are rare, and the total global population may be small. Subpopulation abundance estimates range between 42 and 1,500 individuals, but are anecdotal and subject to bias (Miller and Klimovich 2017). The largest subpopulations and records of individuals come from the Indo-Pacific and eastern Pacific. Ecuador is thought to be home to the largest identified population (n=1,500) of giant manta rays in the world, with large aggregation sites within the waters of the Machalilla National Park and the Galapagos Marine Reserve (Hearn et al. 2014). Within the Indian Ocean, numbers of giant manta rays identified through citizen science in Thailand’s waters (primarily on the west coast, off Khao Lak and Koh Lanta) was 288 in 2016. These numbers reportedly surpass the estimate of identified giant mantas in Mozambique (n=254), possibly indicating that Thailand may be home to the largest aggregation of giant manta rays within the Indian Ocean (MantaMatcher 2016). Miller and Klimovich (2017) concluded that giant manta rays are at risk throughout a significant portion of their range, due in large part to the observed declines in the Indo-Pacific. There have been decreases in landings of up to 95% in the Indo-Pacific, although similar declines have not been observed in areas with other subpopulations, such as Mozambique and Ecuador. In the U.S. Atlantic and Caribbean, giant manta ray sightings are concentrated along the east coast as far north as New Jersey, within the Gulf of Mexico, and off the coasts of the U.S. Virgin Islands and Puerto Rico. Because most sightings of the species have been opportunistic during other surveys, researchers are still unsure what attracts giant manta rays to certain areas and not others and where they go for the remainder of the time (84 FR 66652; Publication Date December 5, 2019).

The available sightings data indicate that giant manta rays occur regularly along Florida’s east coast. In 2010, Georgia Aquarium began conducting aerial surveys for giant manta rays. The surveys are conducted in spring and summer and run from the beach parallel to the shoreline (0 to 2.5 nautical miles), from St. Augustine Beach Pier to Flagler Beach Pier, Florida. The numbers, location, and peak timing of the manta rays to this area varies by year (H. Webb unpublished data). In addition, juvenile giant manta rays have also been regularly observed

inshore off the southeast Florida. Since 2016, researchers with the Marine Megafauna Foundation have been conducting annual surveys along a small transect off Palm Beach, Florida, between Jupiter Inlet and Boynton Beach Inlet (~44 km, 24 nautical miles) (J. Pate, MMF, pers. comm. to M. Miller, NMFS OPR, 2018). Results from these surveys indicate that juvenile manta rays are present in these waters for the majority of the year (observations span from May to December), with re-sightings data that suggest some manta rays may remain in the area for extended periods of time or return in subsequent years (J. Pate unpublished data). In the Gulf of Mexico, within the Flower Garden Banks National Marine Sanctuary, 95 unique individuals have been recorded between 1982 and 2017 (Stewart et al. 2018).

Threats

The giant manta ray faces many threats, including fisheries interactions, environmental contaminants (microplastics, marine debris, petroleum products, etc.), vessel strikes, entanglement, and global climate change. Overall, the predictable nature of their appearances, combined with slow swimming speed, large size, and lack of fear towards humans, may increase their vulnerability to threats (Convention on Migratory Species 2014; O'Malley et al. 2013). The ESA status review determined that the greatest threat to the species results from fisheries related mortality (Miller and Klimovich 2017); (83 FR 2916, Publication Date January 22, 2018).

<u>Commercial Harvest and Fisheries Bycatch</u>

Commercial harvest and incidental bycatch in fisheries is cited as the primary cause for the decline in the giant manta ray and threat to future recovery (Miller and Klimovich 2017). We anticipate that these threats will continue to affect the rate of recovery of the giant manta ray. Worldwide giant manta ray catches have been recorded in at least 30 large and small-scale fisheries covering 25 countries (Lawson et al. 2016). Demand for the gills of giant manta rays and other mobula rays has risen dramatically in Asian markets. With this expansion of the international gill raker market and increasing demand for manta ray products, estimated harvest of giant manta rays, particularly in many portions of the Indo-Pacific, frequently exceeds numbers of identified individuals in those areas and are accompanied by observed declines in sightings and landings of the species of up to 95% (Miller and Klimovich 2017). In the Indian Ocean, manta rays (primarily giant manta rays) are mainly caught as bycatch in purse seine and gillnet fisheries (Oliver et al. 2015). In the western Indian Ocean, data from the pelagic tuna purse seine fishery suggests that giant manta and mobula rays, together, are an insignificant portion of the bycatch, comprising less than 1% of the total non-tuna bycatch per year (Chassot et al. 2008; Romanov 2002). In the U.S., bycatch of giant manta rays has been recorded in the coastal migratory pelagic gillnet, gulf reef fish bottom longline, Atlantic shark gillnet, pelagic longline, pelagic bottom longline, and trawl fisheries. Incidental capture of giant manta ray is also a rare occurrence in the elasmobranch catch within U.S. Atlantic and Gulf of Mexico, with the majority that are caught released alive. In addition to directed harvest and bycatch in commercial fisheries, the giant manta ray is incidentally captured by recreational fishers using vertical line (i.e., handline, bandit gear, and rod-and-reel). Researchers frequently report giant manta rays having evidence of recreational gear interactions along the east coast of Florida (i.e., manta rays have embedded fishing hooks with attached trailing monofilament line) (J. Pate, Florida Manta Project, unpublished data). Internet searches also document recreational interactions with giant manta rays. For example, recreational fishers will search for giant manta rays while targeting cobia, as cobia often accompany giant manta rays (anglers will cast at manta

rays in an effort to hook cobia). In addition, giant manta rays are commonly observed swimming near or underneath public fishing piers where they may become foul-hooked. The current threat of mortality associated with recreational fisheries is expected to be low, given that we have no reports of recreational fishers retaining giant manta ray. However, bycatch in recreational fisheries remains a potential threat to the species.

Vessel Strike

Vessel strikes can injure or kill giant manta rays, decreasing fitness or contributing to non-natural mortality (Couturier et al. 2012; Deakos et al. 2011). Giant manta rays do not surface to breath, but they can spend considerable time in surface waters, while basking and feeding, where they are more susceptible to vessel strikes (McGregor et al., 2019). They show little fear toward vessels which can also make them extremely vulnerable to vessel strikes (Deakos 2010; C. Horn, NMFS, personal observation). Five giant manta rays were reported to have been struck by vessels from 2016 through 2018; individuals had injuries (i.e., fresh or healed dorsal surface propeller scars) consistent with a vessel strike. These interactions were observed by researchers conducting surveys from Boynton Beach to Jupiter, Florida (J. Pate, Florida Manta Project, unpublished data). The giant manta ray is frequently observed in nearshore coastal waters and feeding within and around inlets. As vessel traffic is concentrated in and around inlets and nearshore waters, this overlap exposes the giant manta ray in these locations to an increased likelihood of potential vessel strike. Yet, few instances of confirmed or suspected mortalities of giant manta ray attributed to vessel strike injury (e.g., via strandings) have been documented. This lack of documented mortalities could also be the result of other factors that influence carcass detection (i.e., wind, currents, scavenging, decomposition etc.). In addition, manta rays appear to be able to heal from wounds very quickly, while high wound healing capacity is likely to be beneficial for their long-term survival, the fitness cost of injuries and number vessel strikes occurring may be masked (McGregory et al., 2019).

Microplastics

Filter-feeding megafauna are particularly susceptible to high levels of microplastic ingestion and exposure to associated toxins due to their feeding strategies, target prey, and, for most, habitat overlap with microplastic pollution hotspots (Germanov et al. 2019). Giant manta rays are filter feeders, and, therefore can ingest microplastics directly from polluted water or indirectly through-contaminated planktonic prey (Miller and Klimovich 2017). The effects of ingesting indigestible particles include blocking adequate nutrient absorption and causing mechanical damage to the digestive tract. Microplastics can also harbor high levels of toxins and persistent organic pollutants, and introduce these toxins to organisms via ingestion. These toxins can bioaccumulate over decades in long-lived filter feeders, leading to a disruption of biological processes (e.g., endocrine disruption), and potentially altering reproductive fitness (Germanov et al. 2019). Jambeck et al. (2015) found that the Western and Indo- Pacific regions are responsible for the majority of plastic waste. These areas also happen to overlap with some of the largest known aggregations of giant manta rays. For example, in Thailand, where recent sightings data have identified over 288 giant manta rays (MantaMatcher 2016), mismanaged plastic waste is estimated to be on the order of 1.03 million tonnes annually, with up to 40% of this entering the marine environment (Jambeck et al. 2015). Approximately 1.6 million tonnes of mismanaged plastic waste is being disposed of in Sri Lanka, again with up to 40% entering the marine environment (Jambeck et al. 2015), potentially polluting the habitat used by the nearby Maldives

aggregation of manta rays. While the ingestion of plastics is likely to negatively affect the health of the species, the levels of microplastics in manta ray feeding grounds and frequency of ingestion are presently being studied to evaluate the impact on these species (Germanov et al. 2019).

<u>Mooring and Anchor Lines</u>

Mooring and boat anchor line entanglement may also wound giant manta rays or cause them to drown (Deakos et al. 2011; Heinrichs et al. 2011). There are numerous anecdotal reports of giant manta rays becoming entangled in mooring and anchor lines (C. Horn, NMFS, unpublished data), as well as documented interactions encountered by other species of manta rays (C. Horn, NMFS, unpublished data). For example, although a rare occurrence, reef manta rays on occasion entangle themselves in anchor and mooring lines. Deakos (2010) suggested that manta rays become entangled when the line makes contact with the front of the head between the cephalic lobes, the animal's reflex response is to close the cephalic lobes, thereby trapping the rope between the cephalic lobes, entangling the manta ray as the animal begins to roll in an attempt to free itself. In Hawaii, on at least 2 occasions, a reef manta ray was reported to have died after entangling in a mooring line (A. Cummins, pers. comm. 2007, K. Osada, pers. comm. 2009; cited in Deakos et al. (2011)). In Maui, Hawaii, Deakos et al. (2011) observed that 1 out of 10 reef manta rays had an amputated or disfigured non-functioning cephalic lobe, likely a result of line entanglement. Mobulid researchers indicate that entanglements may significantly affect the manta rays fitness (Braun et al. 2015; Convention on Migratory Species 2014; Couturier et al. 2012; Deakos et al. 2011; Germanov and Marshall 2014; Heinrichs et al. 2011). However, there is very little quantitative information on the frequency of these occurrences and no information on the impact of these injuries on the overall health of the species.

<u>Climate Change Effects</u>

Because giant manta rays are migratory and considered ecologically flexible (e.g., low habitat specificity), they may be less vulnerable to the impacts of climate change compared to other sharks and rays (Chin et al. 2010). However, as giant manta rays frequently rely on coral reef habitat for important life history functions (e.g., feeding, cleaning) and depend on planktonic food resources for nourishment, both of which are highly sensitive to environmental changes (Brainard et al. 2011; Guinder and Molinero 2013), climate change is likely to have an impact on their distribution and behavior. Coral reef degradation from anthropogenic causes, particularly climate change, is projected to increase through the future. Specifically, annual, globally averaged surface ocean temperatures are projected to increase by approximately 0.7 °C by 2030 and 1.4 °C by 2060 compared to the 1986-2005 average (Intergovernmental Panel on Climate Change 2013), with the latest climate models predicting annual coral bleaching for almost all reefs by 2050 (Heron et al. 2016). Declines in coral cover have been shown to result in changes in coral reef fish communities (Jones et al. 2004) (Graham et al. 2008). Therefore, the projected increase in coral habitat degradation may potentially lead to a decrease in the abundance of fish that clean giant manta rays (e.g., *Labroides* spp., *Thalassoma* spp., and *Chaetodon* spp.) and an overall reduction in the number of cleaning stations available to manta rays within these habitats. Decreased access to cleaning stations may negatively affect the fitness of giant manta rays by hindering their ability to reduce parasitic loads and dead tissue, which could lead to increases in diseases and declines in reproductive fitness and survival rates.

Changes in climate and oceanographic conditions, such as acidification, are also known to affect zooplankton structure (size, composition, and diversity), phenology, and distribution (Guinder and Molinero 2013). As such, the migration paths and locations of both resident and seasonal aggregations of giant manta rays, which depend on these animals for food, may similarly be altered (Couturier et al. 2012). As research to understand the exact impacts of climate change on marine phytoplankton and zooplankton communities is still ongoing, the severity of this threat has yet to be fully determined (Miller and Klimovich 2017).

4 ENVIRONMENTAL BASELINE

By regulation, the environmental baseline for an Opinion refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process.

Federal Actions

NMFS issued biological opinions for the ongoing operations at SLNPP in 1977, 2001, and 2016. Unit 1 of the SLNPP became operational in 1976, and Unit 2 became operational in 1983. FPL has an ongoing sea turtle and smalltooth sawfish monitoring, capture, and release program at SLNPP. Please refer to "Conservation and Recovery Actions Shaping the Environmental Baseline" in this section for further information about this program.

State or Private Actions

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, giant manta rays, and smalltooth sawfish in the action 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 (NMFS 2016). Furthermore, we are not aware of any incidental captures of giant manta rays in the action area by recreational fishermen.

Vessel Traffic
Recreational vessel traffic can have an adverse effect on sea turtles and giant manta rays 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 (NMFS 2016).

In-water Research
In Florida, in-water sea turtle research has increased in recent years, but no coordinated trend monitoring program exists for in-water populations (https://myfwc.com/research/wildlife/sea-turtles/research/in-water-monitoring/). 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 action 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.

Other Potential Sources of Impacts to 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 (NMFS 2016).

Conservation and Recovery Actions Shaping the Environmental Baseline

FPL has an ongoing sea turtle and smalltooth sawfish monitoring, capture, and release program at SLNPP. Sea turtles that become entrained in the intake canal are captured, measured, weighed, tagged, and released (if healthy). According to FPL, 341 sea turtles were removed from the intake canal in 2020, including 176 loggerheads, 157 greens, 7 Kemp's ridleys, and 1 leatherback. The majority of these turtles (99.4%) were captured alive and released back to the ocean. In addition, FPL had 2 giant manta ray captures in 2020. According to FPL, both giant manta rays were released back to the ocean.

5 EFFECTS OF THE ACTION

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 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.

We believe sea turtles, giant manta rays, and smalltooth sawfish are likely to experience the following effects associated with the continued operation of SLNPP. Each of these effects is analyzed separately.

- Injury or mortality[9] associated with travel through the intake pipes (Section 5.1);
- Injury or mortality[10] during residence within the intake canal (Section 5.2);
- Stress associated with capture and release (Section 5.3);
- Take of hatchlings associated with sea turtle nesting on the intake canal banks (Section 5.4);
- Thermal effects associated with cooling water discharge (Section 5.5); and
- Effects of the condenser tube cleaning system (Section 5.6)

In addition to the effects listed above, we believe sea turtles could experience the following beneficial effects (Section 5.7) from the proposed action:

- Transportation of non-causally injured and ill sea turtles to a rehabilitation facility
- Research and conservation benefits from data gathered at SLNPP

5.1 Injury or Mortality Associated with Travel through the Intake Pipes

The SLNPP ocean intake system provides cooling water to the SLNPP condensers and auxiliary cooling systems. The system consists of 3 velocity cap structures, 3 ocean intake pipelines, 2 headwall structures, and an intake canal. Ocean water enters the system from 3 reinforced concrete velocity cap structures located approximately 1,200 ft (365 m) offshore and 6.75 ft (2.1 m) below the water surface at Mean Low Water. A vertical sheet pile section minimizes intake of sand and small debris, but no screens or grates prevent sea turtles, fish, and other marine organisms from accessing the intake pipes and traveling through those pipes to the intake canal. Water enters the velocity caps at approximately 1 foot per second (fps) (0.3 meters per second (m/s)) under typical conditions and travels through 1 of 3 intake pipelines (two 12-ft (3.7-m) diameter pipes and one 16-ft (4.9-m) diameter pipe). The intake pipes change angles from horizontal to vertical, and at these transition points, water velocity increases to approximately 4.2

[9] We only anticipate potential mortality of sea turtles. No lethal take is authorized for smalltooth sawfish, giant manta rays, or scalloped hammerhead sharks in this Opinion.
[10] We only anticipate potential mortality of sea turtles. No lethal take is authorized for smalltooth sawfish, giant manta rays, or scalloped hammerhead sharks in this Opinion.

fps (1.3 m/s) in the 12-ft (3.7-m) diameter pipes and 6.8 fps (2.1 m/s) in the 16-ft (4.9-m) diameter pipe. Following travel through the intake pipes, water passes through 2 headwall structures and into a single intake canal where water velocity returns to 1 fps (0.3 m/s) (NRC 2019).

Sea turtles, fish, and other marine organisms that enter the intake structure may be capable of initially escaping entrainment due to the low water flow velocity. However, as organisms approach the vertical pipe transition where water velocity increases, escape likely becomes increasingly difficult. The change in pipe angle may also cause disorientation and further prevent individuals from exiting the pipe (NRC 2019). During travel through the pipes, organisms may sustain injuries of varying degrees of severity. Severe injuries can result in death.

Sea Turtle Injury

During travel through the intake pipes, sea turtles may experience blunt force injury from collisions with the intake pipe itself, other intake structure components, or debris within the pipes. Such injuries may range from minor to severe. In clean, straight sections of the intake pipes, the potential for sea turtle injury associated travel through the pipes is minimal. Injury becomes more likely if the pipes exhibit biofouling or are clogged with other marine debris. During a previous ESA Section 7 consultation for SLNPP operations, FPL personnel, in coordination with the NRC and NMFS, determined that biofouling could be associated with an observed increase in fresh scrapes (NRC 2019). In 2011, FPL cleaned the inside of the velocity caps and 375 ft (114 m) of pipe and removed marine debris from all 3 pipes during a scheduled refueling outage. Following cleaning, FPL personnel observed reduced numbers of sea turtles with fresh scrapes entering the intake canal (NRC 2019). In our 2016 Biological Opinion, NMFS included as a Term and Condition a requirement for FPL to develop a monitoring and maintenance plan to inspect and remove debris and biofouling organisms from the intake pipes (NMFS 2016). Additionally, the 2016 Biological Opinion requires FPL to inspect the intake pipes and initiate corrective actions if the number of turtles with severe or moderate fresh scrapes reach certain percentages of the total number of turtles captured in the intake canal over a consecutive 2-year period (NMFS 2016).

In 2008, FPL biologists began categorizing sea turtle injuries as “severe,” “moderate,” or “minor” (NRC 2019). The FWC and qualified sea turtle veterinarians assisted FPL biologists in creating criteria for how scrapes should be classified into these 3 categories using protocols similar to those implemented at other coastal projects throughout the state of Florida. FPL categorizes scrapes as follows (NRC 2019):

1) **Severe scrapes**: Scrapes that could potentially affect a turtle’s ability to survive. These include scrapes that penetrate the carapace through the bone, or affect the skull, eyes, or plastron. Turtles with severe scrapes are transported to a rehabilitation facility.
2) **Moderate scrapes**: Deeper or longer scrapes (>4 cm or ~1.6 in) than those considered minor, combined with multiple minor scrapes. Moderate scrapes do not affect the health of the turtle. Turtles with moderate scrapes are released back to the ocean.
3) **Minor scrapes**: Fresh, superficial nicks and dings. Such scrapes typically appear as white marks on the carapace. Turtles with minor scrapes are released back to the ocean.

According to the NRC (2019), severe scrapes are relatively rare. During the 2008–2018 period, 8 sea turtles exhibited severe scrapes. Prior to the intake pipe cleaning in 2011, an average of 1.75 turtles per year (2008–2011) sustained severe scrapes during travel through the intake pipes. Following the cleaning of the intake pipes, severe scrapes were practically eliminated; only 1 severe scrape, determined to have been caused during travel through the intake pipe, occurred post-cleaning, for an average of 0.14 turtles per year between 2012 and 2018 (NRC 2019). This severe scrape was of an adult female loggerhead on August 5, 2013. The turtle exhibited a 1.2 x 1.4 in. (3 x 3.5 cm) circular puncture wound through its carapace, which FPL determined, in consultation with FWC, to be caused by SLNPP operations (NRC 2019). Following retrieval from the intake canal, FPL biologists transported the turtle to the Loggerhead Marinelife Center in Juno Beach, Florida, for rehabilitation. The rehabilitation facility treated the turtle and released it back to the ocean on August 14, 2013 (NRC 2019).

The number of moderate scrapes drastically decreased following the intake pipe cleaning in 2011 and have continued to trend downward. From 2012 through 2018, 7.2% of sea turtles (227 of 3,162) captured in the intake canal exhibited moderate scrapes compared to 21.9% (531 of 2,420) of sea turtles captured from 2008 through 2011 (NRC 2019). The intake pipe cleaning did not appear to affect the number of minor scrapes. While the minor scrape numbers initially decreased in 2012, the numbers increased to within the previous range the following year with no clear correlation to the cleaning or an overall trend. From 2012 through 2018, 75.5% of sea turtles (2,386 of 3,162) collected in the intake canal exhibited minor scrapes (NRC 2019).

FPL typically transports turtles with severe scrape injuries determined to be associated with SLNPP operations to one of several local sea turtle rehabilitation facilities. Such injuries are termed "causal" and count against the allowable take limit in the incidental take statement of NMFS's 2016 Biological Opinion. Causal injuries are fresh injuries associated with a turtle's interaction with the SLNPP cooling water intake structure and that do not show signs of injuries from, for example, a boat strike, shark bite, fishing gear interaction, or a cold stunning event (NMFS 2016). FPL also transports turtles to rehabilitation if individuals exhibit serious injury or illness determined to be unassociated with SLNPP operations. These injuries are termed "non-causal." Non-causal injuries are injuries associated with non-plant-related activities and that occur before turtles enter the intake pipes and intake canal (NMFS 2016). In some instances, turtles may exhibit both moderate scrapes related to plant operations in addition to pre-existing non-causal injury or illness. FPL may transport these turtles to rehabilitation, as well (NRC 2019).

In examining the number of turtles sent to rehabilitation, a longer time period can be assessed because the criteria for causal injuries have been well-defined in current and past biological opinions (NMFS 2001, 2016). According to NRC (2019), between 2001 and 2018, FPL transported 344 turtles to rehabilitation for causal and non-causal injuries. Of the 344 injuries, 323 were non-causal and 21 were causal. Of the 21 causal injuries, 20 were attributable to travel through the intake pipes. Prior to the intake pipe cleaning, FPL transported 1 to 2 sea turtles per year (1.64 turtles on average) to rehabilitation with causal injuries related to the intake pipes. Following the cleaning, the number of turtles requiring rehabilitation due to intake pipe-related injuries significantly decreased to roughly 1 turtle every 3 years (0.29 turtles per year). The

remaining causal injury (a juvenile green turtle in 2017) during the 2001–2018 time period was related to the traveling screen and trash rake system and is described below in Section 5.2.

The available sea turtle injury data suggest that under current operating conditions, sea turtles are most likely to sustain minor scrapes as a result of traveling through the intake pipes (NRC 2019). Occasionally, turtles could suffer moderate or severe scrapes, but such injuries occur at relatively low (moderate scrapes) to extremely low (severe scrapes) rates. Causal injuries requiring rehabilitation are rare.

Minor and moderate scrapes generally do not affect long-term health, susceptibility to predation, reproduction, or otherwise affect sea turtles' ability to perform essential life history functions. Severe scrapes result in short-term fitness reductions that can affect individuals' ability to feed, migrate, reproduce, and perform other life history functions. However, treatment of these turtles at rehabilitation facilities increases the likelihood of recovery. In some cases, severe injuries can result in immediate or delayed death (NRC 2019). The next section below discusses sea turtle mortalities.

Under the proposed action, FPL would undertake modifications to the intake pipes that would further reduce the likelihood of injury to sea turtles associated with travel from the ocean through the intake pipes and into the intake canal. FPL proposes to create a smooth transition at the base of the Unit No. 1 velocity caps where the horizontal pipe enters the vertical section of the velocity cap. FPL biologists believe that these modifications would reduce the likelihood of sea turtles experiencing fresh scrape injuries during intake pipe travel. Periodic inspections and cleaning of the intake pipes would also continue under the proposed action. The extent to which these actions would decrease fresh scrape injuries to sea turtles is unknown at this time, but the NRC (2019) assumes that these actions would decrease scrapes of all severities to some degree and may also decrease the number of turtles with causal injuries requiring rehabilitation. Severe fresh scrapes are rare, so a measurable decrease from the currently observed average of such scrapes on 0.03% of all turtles is unlikely. However, a measurable decrease in minor and moderate fresh scrapes, which are currently observed on 75.5% (minor scrapes) and 7.2% (moderate scrapes) of sea turtles would likely be observed following FPL's completion of the proposed intake pipe modifications (NRC 2019).

Sea Turtle Mortality

During travel through the intake pipes, sea turtles may die from injury or forced submergence. Sea turtles that experience severe blunt force injuries may die immediately. Sea turtles may also die later of intake pipe-related injuries if they are transported to a rehabilitation facility but are unable to recover. Sea turtles may also drown through forced submergence if an individual spends too much time within the intake pipe and reaches the end of its breath cycle (NRC 2019).

Like injuries, FPL biologists categorize sea turtle mortalities as causal or non-causal depending on the condition of the individual at the time of retrieval and necropsy results (if performed). Because the criteria for causal and non-causal mortalities are well-defined in current and past Biological Opinions (NMFS 2001 and NMFS 2016), this section examines sea turtle mortalities over the period of 2001–2018. Over this time period, less than 1% of all turtles (98 of 10,592) captured in the intake canal were dead upon retrieval or died of injuries following capture.

Causal and non-causal mortalities were roughly similar during the time period: 40% of mortalities (39) were causal, and 60% of mortalities (59) were non-causal. Causal mortalities occurred in all but 2 years (2009 and 2014), and non-causal mortalities occurred in all but one year (2001) (NRC 2019).

Mortalities associated with travel of sea turtles through the intake pipes are uncommon relative to the number of turtles captured in the intake canal. Over the 2001–2018 period, FPL reported 6 intake pipe-related mortalities (NRC 2019). These accounted for 15.4% of causal mortalities and 6.1% of all mortalities (causal and non-causal). Intake pipe-related mortality appears more likely in cases where a pre-existing injury, disease, or other condition has already weakened the turtle. Three of the intake pipe-related mortalities were adults. Larger sea turtles may be more susceptible to sustaining serious or fatal injuries as they travel through the intake pipes, especially if debris or biofouling is present. The risk of a turtle becoming disoriented and drowning is very low and would only occur under extremely low flow conditions, such as in the 2004 event when a hurricane storm surge resulted in a loss of offsite power and the temporary shutdown of the SLNPP units (NRC 2019). When both SLNPP units are operating, turtles travel through the intake pipes and into the intake canal in less than 5 minutes, which is too short of a duration to drown a sea turtle (NMFS 2016).

Under the baseline conditions, the NRC (2019) assumes that a similar number of sea turtles (0.33 turtles per year or 1 turtle every 3 years) would die as a result of travel through the intake pipes for the remainder of the renewed license terms. Thus, the NRC estimates that up to 9 sea turtles would die between 2018 and 2043 of causally-related injuries associated with travel through the intake pipes. Under the proposed action, however, FPL would undertake modifications to the intake pipes, as previously described, and perform periodic inspections and cleaning of the intake pipes. These operational changes are expected to decrease fresh scrape injuries to sea turtles. Such changes are expected to also reduce the number of turtles that sustain blunt injuries resulting in death. The extent to which these actions would affect the rate of intake pipe-related sea turtle mortalities is unknown at this time (NRC 2019).

Smalltooth Sawfish Incidental Capture

Since SLNPP began operating in 1976 (Unit No. 1) and 1983 (Unit No. 2), FPL has captured 3 smalltooth sawfish in the intake canal. The 3 individuals were captured in May 2005, September 2017, and November 2017, and all were alive, in good health, and released back to the ocean unharmed (NRC 2019).

Stress associated with the incidental capture of smalltooth sawfish is not described in NMFS's 2009 recovery plan, and NRC (2019) identified no sources of information on impingement/entrainment of the species at any power plants beyond the 3 occurrences at SLNPP described above. Smalltooth sawfish interactions with cooling systems are likely rare because of the limited number of power plants within the species' range, the species' large size, and its advanced swimming capabilities (NRC 2019).

Under baseline conditions, NMFS agrees with the NRC (2019) that smalltooth sawfish may occasionally enter the intake velocity caps, travel through the intake pipes, and become

entrapped in the intake canal. Smalltooth sawfish may experience stress associated with incidental capture, handling, and release activities, but such effects would be short-term and would not affect long-term health, susceptibility to predation, reproduction, or otherwise affect their ability to perform essential life history functions. Although smalltooth sawfish would generally arrive in the intake canal unharmed, the intake pipe modifications that FPL proposes to undertake could further reduce the likelihood of smalltooth sawfish injury over the remainder of the SLNPP renewed license terms. To date, all individuals captured at SLNPP have been in good condition (NRC 2019); thus, NMFS does not anticipate any lethal take of smalltooth sawfish associated with the proposed action, and no lethal take of smalltooth sawfish is authorized in this Opinion.

Giant Manta Ray Incidental Capture

On November 18, 2020, FPL informed NMFS of 2 recent giant manta ray incidental captures at SLNPP. The first capture occurred on September 11, 2020, and the second capture occurred on October 23, 2020. FPL reported both giant manta rays were released back to the ocean, unharmed.

Based on the preceding events, NMFS believes giant manta rays may occasionally enter the intake velocity caps, travel through the intake pipes, and become entrapped in the intake canal. In most cases, we believe giant manta rays may experience stress associated with incidental capture, handling, tagging, and release activities, but such effects would be short-term and would not affect long-term health, susceptibility to predation, reproduction, or otherwise affect their ability to perform essential life history functions. NMFS does not anticipate any lethal take of the giant manta ray associated with the proposed action, and no lethal take of this species is authorized in this Opinion.

5.2 Injury or Mortality During Residence within the Intake Canal

Following travel through the intake pipes, sea turtles, giant manta rays, and smalltooth sawfish enter the intake canal. The intake canal is a 4,920-ft (1,500-m)-long trapezoidal channel within which water occupies an area of 180 ft (55 m) wide by 30 ft (9.1 m) deep at typical water levels (NRC 2019). Listed species in the canal may encounter one of several barriers designed to prevent marine organisms from entering the intake wells, which pump water to the main turbine condensers. Occasionally, such as during storm surges that heighten intake canal water levels, sea turtles may travel beyond these barriers and into the intake wells where they can become entrapped and die.

The first permanent barrier that listed species may encounter is a taut, sloped 5-in (12.7-cm) mesh barrier net that spans the width of the intake canal midway between the headwall structures and the State Road A1A bridge (Figure 9). This net is also referred to as the primary barrier net. FPL monitors this net, as well as the canal area between the headwall structures and this net, hourly from a boat during daylight hours and FPL biologists rescue any entangled sea turtles. In good visibility conditions, FPL biologists capture sighted turtles by hand while free diving or with a dip net (NRC 2019).

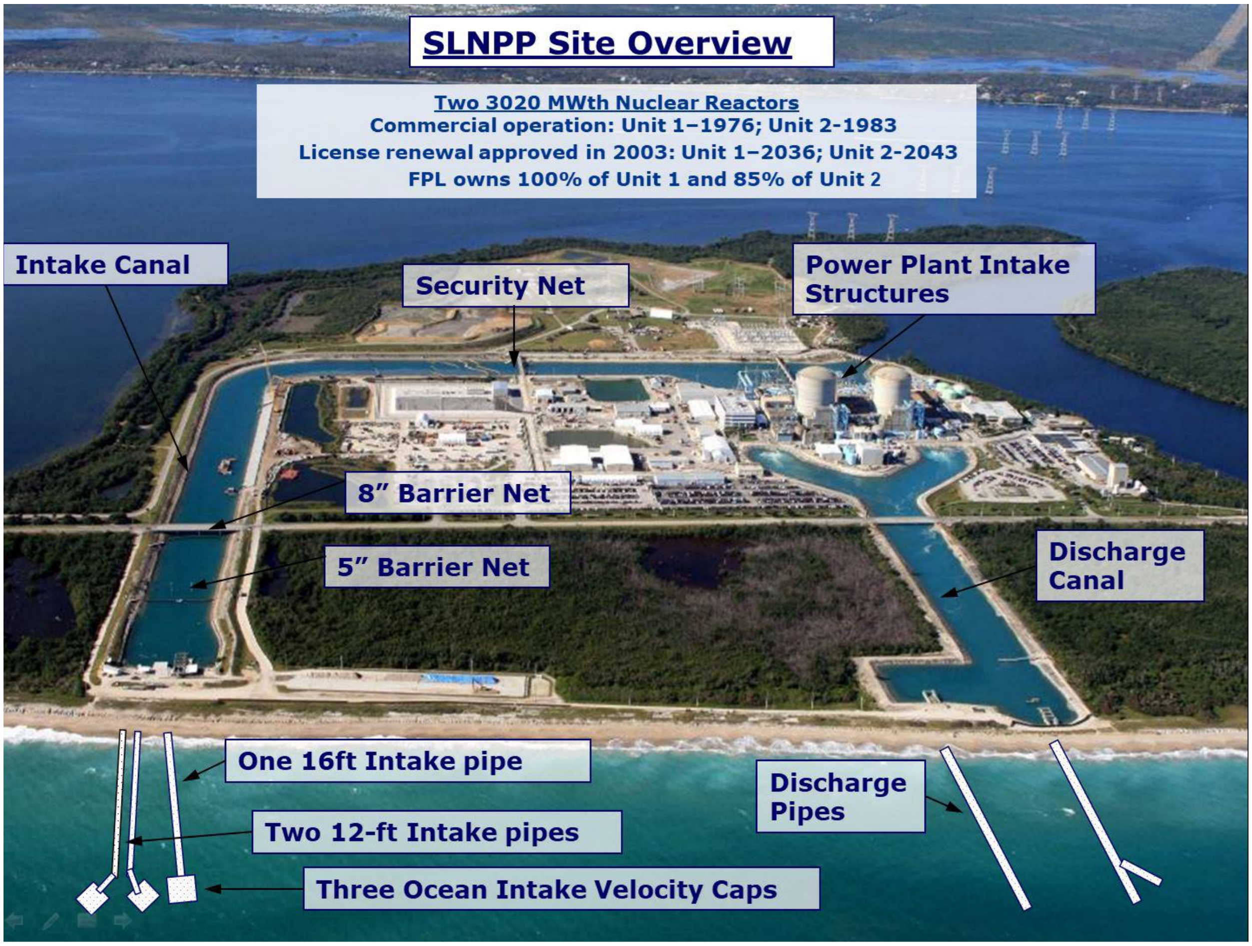

Figure 9. SLNPP Site Overview (NRC 2019).

Listed species in the intake canal may also encounter tangle nets, which are temporary barriers. FPL biologists deploy 2 tangle nets in daylight hours when hand capture and dip-net capture of sea turtles cannot be performed due to low or poor visibility. Tangle nets consist of unweighted, 18-in (56-cm) stretched mesh and are each about 100 ft (30.5 m) long. The nets float at the water's surface and move with water flow. When deployed, biologists inspect the nets at least hourly by boat.

The second permanent barrier that listed species may encounter is an 8-in (20-cm) mesh net that spans the width of the canal immediately east of the A1A Bridge. This net is referred to as the secondary barrier net, and it prevents listed species that have passed the primary barrier net from entering the intake wells. Listed species would typically only encounter this net if the primary barrier net fails due to mesh damage, storm surge, or other events that reduce the integrity of the net (NRC 2019).

If listed species pass both the primary (5-in) barrier net, secondary (8-in) barrier net, and the security net, then individuals will enter the intake wells and become entrapped. Although such occurrences are rare, FPL personnel have discovered small juvenile sea turtles in the intake wells on several occasions, all of which were associated with significant hurricane storm surges that

compromised the integrity of the permanent barrier nets.[11] To date, there have been no reports of smalltooth sawfish or giant manta rays entering the intake wells.

NMFS's 2016 Opinion requires FPL biologists to monitor the intake canal 5 days a week for 8 hours a day under normal conditions (see T&C 7 of RPM 2 in NMFS 2016) and 4 hours a day on holidays. However, FPL biologists currently monitor the intake canal 7 days a week during daylight hours (NRC 2019). FPL also extends its monitoring to 12 hours a day for 7 days a week if biologists identify an adult sea turtle in the canal during nesting or mating season (March 1–October 31); if an individual turtle has remained in the canal for 7 or more days; or if a sick or injured turtle is discovered in the canal. Additionally, FPL biologists extend monitoring during algae, jellyfish, or cold-stunning events and place divers in the water to monitor the integrity of barrier nets. FPL personnel also visually inspect the grating at each intake well for listed species every 6 hours in accordance with T&C 12 of RPM 2 (NMFS 2016). Listed species are rescued and released to the ocean if healthy; transported to a rehabilitation facility if sick or injured (applies to sea turtles only); or transferred to a qualified veterinarian for necropsy (as appropriate) if dead, in accordance with FWC's Marine Turtle Permit (applies to sea turtles only).

Sea Turtle Injury or Mortality

FPL estimates that the average residency time for turtles in the intake canal is 3 days (NRC 2019). During this entrapment period, sea turtles may become injured or die through encounters with the various barriers described above. The largest risk a sea turtle faces during entrapment is the potential for entanglement in one of the barrier nets and subsequent drowning prior to discovery and retrieval.

When the primary barrier net is functioning properly, the risk of sea turtles becoming entangled is low. The net is taut and slopes upward such that if a sea turtle continues to swim against the net in a horizontal direction, the individual would progressively be forced to move upward towards the water's surface. The primary net prevents juvenile, sub-adult, and adult sea turtles present in the intake canal from moving past the net and accessing either the secondary barrier net or the intake wells.

If a sea turtle becomes entangled in a barrier or tangle net and is not promptly discovered, it may drown through forced submergence. Such occurrences are most likely to happen when net integrity is compromised, water clarity is low, or both (NRC 2019). These conditions are most often associated with hurricanes and other significant storm surges when large amounts of seaweed and other marine debris wash into the intake canal and create excessive load and tension on the barrier nets and subsequent net damage or failure. Storms also create hazardous conditions that may require FPL biologists to temporarily suspend intake canal monitoring for human safety reasons. FPL has also experienced several algae and jellyfish events at SLNPP that have complicated sea turtle discovery and retrieval.

[11] In addition, in October 2006, FPL personnel discovered 24 hatchling loggerheads in the intake wells that had hatched from an undetected nest on the banks of the intake canal (NRC 2019). Section 5.4 of this Opinion describes this event and assesses the potential for SLNPP operations to contribute to reproductive failure of sea turtles.

The various permanent and temporary intake canal barriers do not appear to cause injury to sea turtles (NRC 2019). FPL did not report any instances of sea turtles sustaining causal injuries requiring rehabilitation from interactions with intake canal barriers over the period of 2001–2018. Additionally, since FPL biologists began classifying scrape injuries as severe, moderate, or minor in 2008, FPL has reported no sea turtle scrape injuries attributable to intake canal barriers that were distinguishable from scrape injuries associated with travel through the intake pipes (NRC 2019). This information suggests that live sea turtles are generally unlikely to be retrieved from the intake canal with injuries associated with intake canal barriers. Sea turtles that drown in the intake canal may sustain injuries through entanglement with nets or entrapment in intake wells; however, because such entanglement or entrapment typically leads to death, these turtles are counted as causal mortalities rather than causal injuries (NRC 2019).

Sea turtle mortality associated with barrier net entanglement and subsequent drowning poses the largest mortality risk to turtles entrapped in the SLNPP intake canal. Over the period of 2001–2018, FPL reported 27 of the 39 causal sea turtle mortalities (69.2%) to be associated with barrier net entanglement (NRC 2019). Annually, barrier net entanglement resulted in an average of 1.5 sea turtle mortalities over this period. According to NRC (2019), the majority of these mortalities (24) were of juvenile green turtles. The remaining were of loggerhead sub-adults (2) and loggerhead adults (1).

The majority of entanglement deaths have occurred during periods when a storm surge compromised the integrity of the primary barrier net, the secondary barrier net, or both. For example, in September 2017, Hurricane Irma caused severe damage to Florida's coast. Following the storm, FPL discovered damage to both permanent barrier nets. FPL notified NMFS, NRC, and FWC of the net damage and began repairs immediately upon safe work conditions. FPL first worked to fix the secondary barrier net, which was severely damaged. During repairs, FPL overlaid the damaged net with a temporary 5-in (12.7-cm) net to prevent sea turtles from gaining access to the intake wells. Following repairs of the secondary barrier net, FPL dredged east and west of the primary barrier net in order to relieve high tension and loading on the primary barrier net that had created elongated holes in the mesh through which smaller turtles could pass. Finally, FPL biologists increased monitoring efforts throughout all areas of the intake canal during repair activities to minimize sea turtle residency time and potential adverse impacts. FPL completed the repairs in mid-December 2017. Despite FPL's identification and response to the net damage, FPL biologists reported several causal sea turtle mortalities between the initial hurricane storm surge and the completion of net repairs. These mortalities included a juvenile green turtle and a loggerhead sub-adult that drowned from entanglement in the primary barrier net in September 2017 and 2 juvenile green turtles that passed both barrier nets and died in the intake wells in October 2017 (NRC 2019).

Following completion of the initial barrier net repairs, FPL biologists retrieved 4 juvenile green turtles that had passed the primary barrier net and became entangled and drowned in the secondary barrier net in January 2018 and a fifth dead juvenile green turtle on the secondary barrier net in February 2018 (NRC 2019). These mortalities indicated that despite the repairs FPL had already undertaken, the integrity of the primary barrier net remained compromised.

FPL completed a wholesale replacement of the primary barrier net in February 2018. In total, FPL reported 9 causal sea turtle mortalities associated with SLNPP operations and in connection with Hurricane Irma damage between September 2017 and February 2018 (NRC 2019). These mortalities were, in part, the impetus for the NRC's request to reinitiate ESA section 7 consultation with the NMFS in February 2018. Since the replacement of the primary barrier net in February 2018, FPL has reported reduced sea turtle mortality rates associated with barrier net entanglement, and the new net appears to be performing better than the previous net (NRC 2019). FPL has reported only 2 causal sea turtle mortalities associated with the new primary barrier net since its replacement. Both mortalities were of juvenile green turtles during a period of low ocean temperatures and an extreme influx of *Sargassum* algae in the intake canal in February 2019 (NRC 2019).

Sea turtle mortality associated with tangle nets is rare (NRC 2019). FPL reported only 1 such mortality since SLNPP began operating. In June 2002, FPL biologists retrieved a juvenile green turtle that had drowned in a tangle net. FPL biologists reported that the tangle net had been functioning properly prior to discovering the turtle and that the biologists had checked the net for turtles 30 minutes prior to finding the dead individual. The necropsy did not reveal any significant physical abnormalities or other causes of death; therefore, FPL attributed the death to drowning and reported it as a causal mortality (NRC 2019).

Sea turtle injury or mortality associated with entrapment in the intake wells is fairly uncommon because sea turtles cannot normally access the intake wells. Over the 2001–2018 period, FPL reported only 1 intake well-related injury (in 2017) of a juvenile green turtle that sustained a puncture wound in its carapace. This puncture wound occurred due to the sea turtle's interaction with the traveling screens and trash rake system prior to discovery (NRC 2019). Over the same period (2001-2018), FPL reported 5 intake well-related mortalities, which accounted for 12.8% of causal mortalities and 5.1% of all mortalities (causal and non-causal) (NRC 2019). All mortalities were of juvenile green turtles, and all were directly related to barrier net failures caused by significant hurricane storm surges. In the case of each injury and mortality, net failures allowed smaller sea turtles to pass the primary and secondary barrier nets and gain access to the intake wells. Since the replacement of the primary barrier net in February 2018, FPL has not reported any sea turtle injuries or mortalities associated with the intake wells (NRC 2019).

As stated in their Biological Assessment (NRC 2019), under baseline conditions, NRC assumes that live sea turtles that are captured and released to the ocean would not sustain injuries during residency in the intake canal. Moreover, NRC assumes some level of sea turtle mortality associated with the barrier nets would continue over the remainder of the SLNPP renewed license terms because the nets are an entanglement hazard. However, NRC expects the future mortality rate would be significantly less than the rate of 1.5 turtles per year observed from 2001 through 2018 due to the improved performance of the new primary barrier net. The degree to which the new net would decrease causal sea turtle mortalities is unclear because the new net has only been in place since 2018. Future barrier net-related mortalities would continue to be most likely during significant storm surges, and juveniles would continue to be the most likely age class to die of entanglement because their smaller size makes them more likely to become entangled in the barrier nets' mesh. The new primary barrier net should also prevent sea turtles from gaining access to the intake wells and dying of entrapment. Nonetheless, severe storm

surges could occasionally damage barrier nets or raise water levels above the nets and allow sea turtles to pass the nets. For these reasons, sea turtle injury or mortality associated with the intake wells remains possible. NRC believes the 1 tangle net death to be an anomaly and that it is reasonable to expect no further sea turtle deaths attributable to tangle nets during the remainder of the renewed license terms (NRC 2019).

FPL's continued monitoring of the intake canal, as required by NMFS (NMFS 2016), should continue to minimize sea turtle residency time and increase the likelihood of discovery prior to a sea turtle becoming entangled and drowning. FPL biologists also undertake immediate direct capture efforts if a sea turtle is observed in the intake canal west of the secondary barrier net to prevent the turtle from entering the intake wells, in accordance with Term & Condition 11 of Reasonable and Prudent Measure 2 (NMFS 2016), which is carried forward in this Opinion.

Smalltooth Sawfish and Giant Manta Ray Incidental Capture

As described previously in Section 5.1, FPL has incidentally captured 3 smalltooth sawfish at SLNPP since the plant began operating. All 3 individuals were alive, in good health, and released back to the ocean unharmed (NRC 2019). Individuals within the action area are expected to be large sub-adults [>4 m (>13 ft) in length] or adults and, therefore, human observation of such individuals would be expected. NMFS (2016) concluded that any smalltooth sawfish that enter the intake canal could be captured and released alive based on the past successful capture of a smalltooth sawfish in 2005. The 2 additional captures of live, healthy smalltooth sawfish in 2017 further support this conclusion. Based on the past successful release of the 3 healthy individuals incidentally captured, we believe the lethal take of smalltooth sawfish at SLNPP is extremely unlikely to occur, and no lethal take is authorized in this Opinion. Moreover, based on the successful capture and release of smalltooth sawfish to date, NMFS expects that any sawfish discovered in the intake canal could be captured and released alive and unharmed.

Furthermore, FPL has incidentally captured 2 giant manta rays since the plant began operating. FPL stated both giant manta rays were released back to the ocean. Giant manta rays within the action area are expected to be large sub-adults or adults and, therefore, human observation of such individuals would be expected. Based on the past successful release of the individuals incidentally captured, we believe the lethal take of giant manta rays at SLNPP is extremely unlikely to occur, and no lethal take is authorized in this Opinion.

5.3 Stress Associated with Capture and Release

Listed species in the intake canal cannot return to the ocean without human interaction. Listed species may experience stress from handling, tagging, and transporting associated with capture and release. FPL biologists perform measurements and gather basic biological data on all captured sea turtles in accordance with Term & Condition 14 of Reasonable and Prudent Measure 2 (NMFS 2016). Biologists also tag captured sea turtles with passive integrated transponders (PIT) and flipper tags, unless turtles exhibit signs of flipper scarring or damage. FPL biologists are required to receive training on proper sea turtle handling techniques, and sea turtle handling time, including tagging and data collection, which is limited to 30 minutes when possible to minimize stress (NMFS 2016).

Each of the 3 smalltooth sawfish that FPL biologists captured in the SLNPP intake canal were discovered when the individuals became entangled in sea turtle tangle nets (NRC 2019). Following the first event in 2005, FPL biologists underwent sawfish handling training at the Mote Marine Laboratory in 2006, and FPL and NMFS jointly created smalltooth sawfish handling, transportation, and release protocols, which FPL adopted in 2007 to minimize the effects on any captured smalltooth sawfish. Based on the successful capture and release of smalltooth sawfish to date, NMFS expects that any sawfish discovered in the intake canal could be captured and released alive and unharmed. As mentioned above, NMFS believes that any stress to otherwise healthy smalltooth sawfish associated with capture and release activities during the remainder of the SLNPP renewed license terms would be insignificant, so long as FPL biologists follow the requisite safe handling protocols.

In collaboration with the Marine Megafauna Foundation, Georgia Aquarium, and Inwater Research Group, NMFS developed Safe Handling, Tagging, and Release Requirements for Giant Manta Rays (Appendix A). NMFS believes that any stress to otherwise healthy giant manta rays associated with capture and release activities during the remainder of the SLNPP renewed license terms would be insignificant, so long as FPL biologists follow the Safe Handling, Tagging, and Release Requirements for Giant Manta Rays (Appendix A).

5.4 Take Associated with Sea Turtle Nesting on the Intake Canal Bank

During the 2006 sea turtle nesting season, an entrapped female loggerhead emerged from the intake canal and nested on the canal banks. At that time, the top half of the canal banks consisted of sand and gravel substrate with sparse vegetation, which camouflaged the nest, and the nest went undetected by FPL personnel (NRC 2019). In October 2006, the newly hatched sea turtles entered the intake canal water and were carried by the current into the intake wells. FPL personnel discovered and retrieved the hatchlings over a 2-day period on October 25 and October 26, 2006. Twenty-one loggerhead hatchlings drowned in the intake wells prior to retrieval. These counted as causal mortalities against the allowable take set forth in the incidental take statement of NMFS's 2001 Biological Opinion. Three live hatchlings were sent to the Loggerhead Marinelife Center in Juno Beach, Florida, for rehabilitation.

Following this event, FPL removed all vegetation from the intake canal banks east of the primary barrier net and replaced it with raked gravel near the headwall area and stone pavers interspersed with raked gravel closer to the primary barrier net. FPL biologists also began actively searching the canal banks east of the primary barrier net for turtle tracks and other signs of nesting each morning during nesting season. In 2016, NMFS formalized canal bank monitoring as a Term and Condition of our 2016 Opinion (see T&C 6 of RPM 2 in NMFS 2016), which is carried forward in this Opinion.

FPL biologists have not observed any nesting attempts since the 2006 event, and FPL's daily monitoring of the canal banks reduces the risk of a nest going undetected. The conversion of the canal banks to gravel and pavers, which provides no camouflage or cover, further discourages females from nesting on the canal banks. Based on FPL's monitoring efforts and the conversion

of the canal banks to gravel and pavers, we believe the likelihood of future nesting on the canal banks is extremely unlikely to occur.

5.5 Thermal Effects Associated with Cooling Water Discharge

Section 6.1.4 of NMFS's 2016 Opinion addresses effects of the SLNPP discharge system 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, giant manta rays, 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 adversely affect listed species; therefore, we find that effects of the discharge systems on sea turtles, giant manta rays, and sawfish would be insignificant.

5.6 Effects of the Condenser Cleaning System

The released sponge balls from the SLNPP condenser cleaning system could harm sea turtles, giant manta rays, and 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 their gut contents (NMFS 2016). Because smalltooth sawfish are demersal and feed on benthic organisms, they are unlikely to ingest the floating sponge balls.

We believe the only 2 species that may be at risk of ingesting sponge balls are hawksbill sea turtles and giant manta rays. Hawksbill sea turtles, in particular, are known to forage on sponges. Giant manta rays are filter feeders that primarily feed on plankton. Because they are filter feeders, we believe it is possible that giant manta rays could also ingest sponge balls. FPL stated the sponge balls are made from natural latex that will biodegrade after about 2 months in the marine environment (K. Eaton, FPL, pers. comm. to A. Livergood, NMFS, 2/12/21). Because we expect the sponge balls to biodegrade after about 2 months in the ocean and because ocean currents will disperse the small number of sponge balls that are released, we believe it is extremely unlikely that a giant manta ray or a hawksbill sea turtle will ingest a sponge ball.

5.7 Beneficial Effects of the Continued Operation of SLNPP on Sea Turtles

Transport of Injured and Sick Sea Turtles to Rehabilitation

Sea turtles retrieved from the intake canal with serious injuries (regardless of causality) or illness are transported to a rehabilitation facility within the Florida Sea Turtle Stranding and Salvage Network. FPL biologists consult with members of this network and with FWC, in accordance with FPL's Marine Turtle Permit issued by FWC and NMFS's 2016 Opinion, to determine how to handle each injured or ill turtle. Typical non-causal injuries include boat strike injuries, entanglement with and wounds associated with fishing gear, and shark bites. Ill or diseased

turtles typically exhibit a combination of papillomas, buoyancy issues, lethargy, and may be underweight or emaciated (NRC 2019).

Non-causal injury and illness accounts for the vast majority of sea turtles that enter the SLNPP intake canal requiring rehabilitation. From 2001 through 2018, FPL sent 323 sea turtles with non-causal injury and illness to rehabilitation, which accounted for 94% of all sea turtles transported to rehabilitation over this time period (NRC 2019). In its excluder device test evaluation report, FPL examined rehabilitation data for the period 2006–2017, during which FPL transported 216 turtles to rehabilitation facilities. Of the 216 individuals, 203 (94%) exhibited injury or illness that was not causally-related to SLNPP operations (FPL 2018). Following treatment, the rehabilitation facilities successfully released 72% of the turtles (155) transferred for care. Of the remaining turtles, 22% (48 turtles) died or were euthanized while in rehabilitation, 4% (9 turtles) were continuing rehabilitation at the time of reporting, and the remainder (4 turtles) were deemed non-releasable and transferred to aquariums for long-term care. FPL reports that many rehabilitated turtles were in conditions when retrieved from the intake canal that would have likely resulted in death without intervention and care (FPL 2018). Under the proposed action, FPL would continue the transport of non-causally injured and ill sea turtles to rehabilitation facilities during the remainder of the SLNPP renewed license terms. We believe the continuation of this effort will result in beneficial effects to sea turtles.

Research and Conservation Benefits from Data Gathered at SLNPP

Since SLNPP began operating in 1976, FPL has captured over 16,000 sea turtles of 6 species (in order of abundance: loggerhead, green, hawksbill, Kemp’s ridley, leatherback, and 1 olive ridley) in the plant’s intake canal (FPL 2020). According to FPL (2018), SLNPP sea turtle data appear in more than 23 scientific publications; 17 conference presentations, workshops, and meetings; and numerous agency documents, including NMFS’s 1991 and 2008 recovery plans for green and loggerhead sea turtles. Several Masters and Doctoral students have used SLNPP sea turtle data to complete theses on sea turtle health, growth rates, sex ratios, and site fidelity (FPL 2018). Under the proposed action, FPL would continue to gather data on sea turtles that enter the SLNPP intake canal, and this data would continue to contribute to the scientific community’s understanding of sea turtle biology and conservation. We believe the continuation of FPL’s research and data gathering is a beneficial effect on sea turtles.

5.8 Other Activities

NMFS is not aware of any other activities that are caused by the proposed action.

5.9 Approach to Determining Take Estimates in this Opinion

We have decided to take a different approach than the approach taken in the 2016 Opinion to calculate incidental take. The 2016 Opinion set annual limits on incidental take at SLNPP. Annual take estimates of the affected species can have variability because of natural and anthropogenic factors. Based on our experience monitoring fisheries in which there is similar interannual variability in protected species interactions, we believe a 3-year time period is appropriate for setting take limits in this Opinion. This approach will allow us to reduce the

likelihood of requiring reinitiation of ESA Section 7 consultation unnecessarily because of inherent variability in take levels, but still allow for an accurate assessment of how the proposed action is affecting these species versus our expectations.

In order to estimate the amount of take anticipated from the proposed action, we used capture data, as well as data on causal injuries and causal mortalities, provided by FPL in their Annual Environmental Operating Reports for the years 2016 – 2019.[12] Because the Annual Environmental Operating Report for 2020 was not yet available at the time of this writing, we used capture data, as well as data on causal injuries and causal mortalities, provided in FPL's monthly capture summaries from January 2020 – December 2020. These most recent 5 years of data are expected to reflect the most recent status and trends for the affected species and for plant operations. Therefore, they represent the best available information for take that is currently occurring, as well as estimating future take at the plant. For giant manta rays, we used the information provided by FPL in their November 18, 2020 report. FPL confirmed there have only been 2 recorded giant manta ray captures at SLNPP (K. Eaton, FPL, pers. comm. to A. Livergood, NMFS, February 3, 2021).

Based on the available information cited above, we have taken an average (over 5 years) of actual captures, causal injuries, and causal mortalities at SLNPP. Once we have the average for each take category listed above, we then multiply the average by 3 years. In the following paragraphs, we provide a species by species explanation of our approach.

Approach to Take Estimates for Loggerhead Sea Turtles

For loggerhead sea turtles, the average number of captures recorded between 2016 and 2020 was 243 captures. We multiplied 243 by 3 years, and the product is 729 captures in a 3-year period. Therefore, FPL would not be permitted to exceed 729 captures in a 3-year period, beginning in 2022 and ending in 2024. That same formula would be applied, in 3-year increments, from 2025 through 2041 (e.g., 2025-2027, 2028-2030, etc.). The Opinion authorizes incidental take through 2043, which is the year the Unit 2 license expires.[13] For year 2043, we used the same approach described above; however, we grouped year 2043 with years 2040-2042 (thus, 4 years instead of 3 years – i.e., 243 captures multiplied by 4 years is 972 allowable captures). In addition, based on the average number of causal injuries and causal mortalities reported over the same time period, we expect the additional nonlethal take of 1 loggerhead turtle every 3 years and the lethal take of 3 additional loggerhead turtles every 3 years.

Approach to Take Estimates for Hawksbill Sea Turtles

[12] These data categorize turtle interactions at the facility by discrete categories: captures, causal injuries, and causal mortalities. Captures are the animals that enter the cooling water intake and are removed uninjured. Causal injuries are fresh injuries associated with a turtle's interaction with the SLNPP cooling water intake structure that do not show signs of injuries from another source. Causal mortalities are turtles that suffer mortality as a result of their interations with the facility. These categories of interactions are discrete, so a single interaction with a single animal cannot be counted in multiple categories. Further, the categories must be added to get the total number of sea turtle interaction documented at the facility for a given time period.

[13] In taking a conservative approach and avoiding underestimating potential effects, we went with the longer license period for both units (i.e., the year 2043).

For hawksbill sea turtles, the average number of captures recorded between 2016 and 2020 was 1.4 captures (which we rounded to 2 captures, because it is not possible to capture a fraction of an animal). We multiplied 2 captures by 3 years, and the product is 6 captures in a 3-year period. Therefore, FPL would not be permitted to exceed 6 captures in a 3-year period, beginning in 2022 and ending in 2024. That same formula would be applied, in 3-year increments, from 2025 through 2041. The Opinion authorizes incidental take through 2043, which is the year the Unit 2 license expires. For year 2043, we used the same approach described above; however, we grouped year 2043 with years 2040-2042 (thus, 4 years instead of 3 years – i.e., 2 captures multiplied by 4 years is 8 allowable captures). No causal injuries or causal mortalities are expected for hawksbill turtles.

Approach to Take Estimates for Kemp's Ridley Sea Turtles

For Kemp's ridley sea turtles, the average number of captures recorded between 2016 and 2020 was 8 captures. We multiplied 8 captures by 3 years, and the product is 24 captures in a 3-year period. Therefore, FPL would not be permitted to exceed 24 captures in a 3-year period, beginning in 2022 and ending in 2024. That same formula would be applied, in 3-year increments, from 2025 through 2041. The Opinion authorizes incidental take through 2043, which is the year the Unit 2 license expires. For year 2043, we used the same approach described above; however, we grouped year 2043 with years 2040-2042 (thus, 4 years instead of 3 years - i.e., 8 captures multiplied by 4 years is 32 allowable captures). In addition, based on the average number of causal mortalities over the same time period, we expect the additional lethal take of 1 additional Kemp's ridley turtle every 3 years. No causal injuries are expected for Kemp's ridley turtles.

Approach to Take Estimates for Leatherback Sea Turtles

For leatherback sea turtles, the average number of captures recorded between 2016 and 2020 was 0.6 capture (which we rounded to 1 capture, because it is not possible to capture a fraction of an animal). We multiplied 1 capture by 3 years, and the product is 3 captures in a 3-year period. Therefore, FPL would not be permitted to exceed 3 captures in a 3-year period, beginning in 2022 and ending in 2024. That same formula would be applied, in 3-year increments, from 2025 through 2041. The Opinion authorizes incidental take through 2043, which is the year the Unit 2 license expires. For year 2043, we used the same approach described above; however, we grouped year 2043 with years 2040-2042 (thus, 4 years instead of 3 years - i.e., 1 capture multiplied by 4 years is 4 allowable captures). No causal injuries or causal mortalities are expected for leatherback turtles.

Approach to Take Estimates for Green Sea Turtles

The approach we have described above applies to all ESA-listed species covered in this Opinion with the exception of green sea turtles. Because there has been a significant increase in the annual rate of captures of immature green sea turtles at SLNPP from 1977 to 2002 (M. Bresette, Inwater Research Group, unpulished data; Witherington et al. 2006) as well as a positive trend in nesting in recent years (Figure 5) that we expect will continue, we believe it is appropriate to use the maximum documented captures, the maximum documented causal injuries, and the maximum documented causal mortalities to calculate the expected take over a 3-year period for this species. That is, for green sea turtles, the highest number of captures recorded between 2016 and 2020 was in 2019 with 260 captures. We multiplied 260 by 3 years, and the product is 780

captures in a 3-year period. Therefore, FPL would not be permitted to exceed 780 captures in a 3-year period, beginning in 2022 and ending in 2024. That same formula would be applied, in 3-year increments, from 2025 through 2041. As we stated above, the Opinion authorizes incidental take through 2043, which is the year the Unit 2 license expires. For year 2043, we used the same approach described above; however, we grouped year 2043 with years 2040-2042 (thus, 4 years instead of 3 years - i.e., 260 captures multiplied by 4 years is 1,040 allowable captures). In addition, based on the highest number of causal injuries and causal mortalities reported over the same time period, we expect the additional nonlethal take of 4 green turtles every 3 years and the lethal take of 19 every 3 years.

Effects of Sea Turtle Deterrents

The take estimates in this Opinion are based on the baseline condition, which is no sea turtle deterrent(s) at the 3 ocean water intake structures. Once implemented, we expect the deterrent(s) to reduce interactions with sea turtles, thereby reducing the number of sea turtle takes anticipated from the proposed action. However, at this time, there are too many uncertainties surrounding the type of deterrent(s) that will be implemented for us to accurately estimate an anticipated reduction in take. We will have a much better understanding of the expected results of the sea turtle deterrent(s) after they have been implemented, and we obtain data regarding effectiveness. We acknowledge that we may need to re-evaluate the take estimates once Reasonable and Prudent Measure No. 1 (and its implementing Terms and Conditions) in this Opinion is fully implemented.

Approach to Take Estimates for Smalltooth Sawfish

For smalltooth sawfish, the average number of captures recorded between 2016 and 2020 was 0.6 capture (which we rounded to 1 capture, because it is not possible to capture a fraction of an animal). We multiplied 1 capture by 3 years, and the product is 3 captures in a 3-year period. Therefore, FPL would not be permitted to exceed 3 captures in a 3-year period, beginning in 2022 and ending in 2024. That same formula would be applied, in 3-year increments, from 2025 through 2041. The Opinion authorizes incidental take through 2043, which is the year the Unit 2 license expires. For year 2043, we used the same approach described above; however, we grouped year 2043 with years 2040-2042 (thus, 4 years instead of 3 years - i.e., 1 capture multiplied by 4 years is 4 allowable captures). No causal injuries or causal mortalities are expected for smalltooth sawfish.

Approach to Take Estimates for Giant Manta Rays

For giant manta rays, the average number of captures recorded between 2016 and 2020 was 0.4 capture (which we rounded to 1 capture, because it is not possible to capture a fraction of an animal). We multiplied 1 capture by 3 years, and the product is 3 captures in a 3-year period. Therefore, FPL would not be permitted to exceed 3 captures in a 3-year period, beginning in 2022 and ending in 2024. That same formula would be applied, in 3-year increments, from 2025 through 2041. The Opinion authorizes incidental take through 2043, which is the year the Unit 2 license expires. For year 2043, we used the same approach described above; however, we grouped year 2043 with years 2040-2042 (thus, 4 years instead of 3 years - i.e., 1 capture multiplied by 4 years is 4 allowable captures). No causal injuries or causal mortalities are expected for giant manta rays.

6 CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, or local private actions that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA (50 CFR 402.02).

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, giant manta rays, and smalltooth sawfish include incidental capture by fishermen, interaction with marine debris, chemical discharges, and anthropogenic noise. Anticipated effects on sea turtles and giant manta rays, in particular, include vessel strikes. If boating and fishing activities increase, possible effects may increase as well.

7 JEOPARDY ANALYSIS

The analyses conducted in the previous sections of this Opinion serve to provide a basis to determine whether the proposed action would be likely to jeopardize the continued existence of 5 species of sea turtles (Table 1), giant manta ray, and smalltooth sawfish. In Section 5, we outlined how the proposed action may affect these species. Now, we turn to an assessment of the species' response to these impacts, in terms of overall population effects, and whether those effects of the proposed action, when considered in the context of the status of the species (Section 3), the environmental baseline (Section 4), and the cumulative effects (Section 6), will jeopardize the continued existence of the affected species.

"To jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and the recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). Thus, in making this determination, we must first determine whether there will be a reduction in the reproduction, numbers, or distribution. Then, if there is a reduction in 1 or more of these elements, we evaluate whether it will cause an appreciable reduction in the likelihood of both the survival and the recovery of the affected species.

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

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

Survival and Recovery of Green Sea Turtles

Within U.S. waters, individuals from both the NA and SA DPS of the green sea turtle can be found on foraging grounds. While there are currently no in-depth studies available to determine the percent of NA and SA DPS individuals in any given location, on the Atlantic coast of Florida, a study on the foraging grounds off Hutchinson Island found that approximately 5% of the turtles sampled came from the Aves Island/Suriname nesting assemblage, which is part of the SA DPS (Bass and Witzell 2000). This information suggests that the vast majority of the anticipated captures in the Atlantic Ocean are likely to come from the NA DPS. However, it is possible that animals from the SA DPS could be captured as a result of the proposed action. For these reasons, we will act conservatively and conduct 2 jeopardy analyses, 1 for each DPS. The NA DPS analysis will assume, based on Bass and Witzell (2000), that 95% of animals captured during the proposed action are from that DPS. Our analysis of the SA DPS will consider that 5% of the green sea turtles affected by the proposed action are from that DPS.

The proposed action may result in the nonlethal take (i.e., capture) of 780 green turtles every 3 years over a consecutive 22-year period (from 2022 through 2043[14]), for a total of 5,720 green turtles. In addition, the proposed action may result in the nonlethal injury of 3 green turtles every 3 years over a consecutive 22-year period, for a total of 22 green turtles. All turtles that have sustained injuries (e.g., scrapes) requiring treatment would be sent to a rehabilitation facility after consultation with FWC. Moreover, the proposed action may result in the lethal take of 19 green turtles every 3 years over a consecutive 22-year period (from 2022 through 2043), for a total of 133 green turtles.

Applying the above percentages (95% from the NA DPS and 5% from the SA DPS) to our estimated nonlethal take of 5,720 green sea turtles, we estimate the following:

- Up to 5,434 green sea turtles will come from the NA DPS (5,720 × 0.95 = 5,434 green turtles).
- Up to 286 green sea turtles will come from the SA DPS (5,720 × 0.05 = 286 green turtles).

Similarly, when we apply the above percentages to our estimated lethal take of 132 green sea turtles, we estimate the following:

- Up to 126 green sea turtles will come from the NA DPS (133 × 0.95 = 126.35 turtles, rounded up to 127 green turtles).
- Up to 7 green sea turtles will come from the SA DPS (133 × 0.05 = 6.65 turtles, rounded up to 7 green turtles).

[14] The license for Unit 2 expires on April 6, 2043, but consistent with taking a conservative approach to the analysis, we analyze the effects through the end of 2043.

NA DPS of the Green Sea Turtle

Survival

The proposed action may result in the nonlethal take of up to 5,434 green sea turtles from the NA DPS over a consecutive 22-year period (from 2022-2043). The potential nonlethal take of up to 5,434 green sea turtles from the NA DPS is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering nonlethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a tiny portion of green sea turtles' overall range/distribution within the NA DPS. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of NA DPS green sea turtles would be anticipated.

The potential lethal take of up to 127 green sea turtles from the NA DPS during a consecutive 22-year period would reduce the number of NA DPS green sea turtles, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. A lethal interaction would also result in a potential reduction in future reproduction, assuming the individuals are female and would have survived otherwise to reproduce. For example, as discussed in this Opinion, an adult green sea turtle can lay up to 7 clutches (usually 3-4) of eggs every 2-4 years, with up to an average of 110-115 eggs/nest, of which a small percentage is expected to survive to sexual maturity. The anticipated lethal take is expected to occur in a small, discrete action area and green sea turtles in the NA DPS generally have large ranges; thus, no reduction in distribution is expected from the take of these individuals. Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. In the Status of Species, we presented the status of the NA DPS, outlined threats, and discussed information on estimates of the number of nesting females and nesting trends at primary nesting beaches. In the Environmental Baseline, we outlined the past and present impacts of all state, federal, or private actions and other human activities in or having effects in the action area that have affected and continue to affect the NA DPS. In the Cumulative Effects, we discussed the effects of future state, tribal, local, or private actions that are reasonably certain to occur within the action area.

In Section 3, we summarized the available information on the number of green sea turtle nesters and nesting trends at NA DPS beaches; all major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015). Therefore, nesting at the primary nesting beaches has been increasing over the course of the decades, against the background of the past and ongoing human and natural factors that have contributed to the Status of the Species. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. In the absence of any total population estimates, nesting trends are the best proxy for estimating population changes. Since the nesting trend information for the NA DPS of the green sea turtle is clearly increasing, we believe the lethal take of up to 127 green sea turtles from the NA DPS during a consecutive 22-year period attributed to the proposed action will not have any measurable effect on that trend. After analyzing the magnitude of the effects, in combination

with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the green sea turtle NA DPS in the wild.

Recovery

The NA DPS of the green sea turtles does not have a separate recovery plan at this time. However, an Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) does exist. Since the animals within the NA DPS all occur in the Atlantic Ocean and would have been subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the NA DPS, is developed. The Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

- *The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*
- *A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.*

According to data collected from Florida's index nesting beach survey from 1989-2021, green sea turtle nest counts across Florida have increased substantially from a low of approximately 267 in the early 1990s to a high of approximately 41,000 in 2019. Two consecutive years of nesting declines in 2008 and 2009 caused some concern, but this was followed by increases in 2010 and 2011, and a return to the trend of biennial peaks in abundance thereafter. These data also indicate that the average number of nests in Florida for the 6 years prior to and including 2017 has been well above 5,000 (average of approximately 17,000 nests from 2010-2017; see Figure 5), indicating that the first listed recovery objective is currently being met. There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in nesting; however, it is likely that numbers on foraging grounds have increased, which is consistent with the criteria of the second listed recovery objective.

The potential lethal take of up to 127 green sea turtles from the NA DPS over a consecutive 22-year period will result in a reduction in numbers when a capture occurs, but it is unlikely to have any detectable influence on the recovery objectives and trends noted above, even when considered in the context of the of the Status of the Species, the Environmental Baseline, and Cumulative Effects sections discussed in this Opinion. The nonlethal take of up to 5,434 green sea turtles from the NA DPS over a consecutive 22-year period would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not impede achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of NA DPS green sea turtles' recovery in the wild.

Conclusion

NMFS believes similar take levels for the NA DPS of the green sea turtle have been occurring over the life of SLNPP; although, numbers have increased along with green sea turtle population

increases. Regardless, the level of past take has not precluded population growth. NMFS believes the same is generally true for all sea turtle species in the action area. Thus, we conclude the lethal and nonlethal take of green sea turtles from the NA DPS associated with the proposed action is not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the NA DPS of the green sea turtle in the wild.

SA DPS of the Green Sea Turtle

Survival

The proposed action may result in the nonlethal take of up to 286 green sea turtles from the SA DPS over a consecutive 22-year period (from 2022-2043). The potential nonlethal take of up to 286 green sea turtles from the SA DPS is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The individuals suffering nonlethal injuries or stresses are expected to fully recover such that no reductions in reproduction or numbers of green sea turtles are anticipated. The captures may occur anywhere in the action area, which encompasses only a tiny portion of green sea turtles' overall range/distribution within the SA DPS. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of SA DPS green sea turtles would be anticipated.

The potential lethal take of up to 7 green sea turtles from the SA DPS during a consecutive 22-year period would reduce the number of SA DPS green sea turtles, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. A lethal interaction would also result in a potential reduction in future reproduction, assuming the individuals are female and would have survived otherwise to reproduce. For example, as discussed in this Opinion, an adult green sea turtle can lay up to 7 clutches (usually 3-4) of eggs every 2-4 years, with up to an average of 110-115 eggs/nest, of which a small percentage is expected to survive to sexual maturity. The anticipated lethal take is expected to occur in a small, discrete action area and green sea turtles in the SA DPS generally have large ranges; thus, no reduction in distribution is expected from the take of these individuals. Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. In the Status of Species, we presented the status of the SA DPS, outlined threats, and discussed information on estimates of the number of nesting females and nesting trends at primary nesting beaches. In the Environmental Baseline, we outlined the past and present impacts of all state, federal, or private actions and other human activities in or having effects in the action area that have affected and continue to affect the SA DPS. In the Cumulative Effects, we discussed the effects of future state, tribal, local, or private actions that are reasonably certain to occur within the action area.

In Section 3, we summarized the available information on the number of green sea turtle nesters and nesting trends at SA DPS beaches; all major nesting populations demonstrate long-term increases in abundance (Seminoff et al. 2015). Therefore, nesting at the primary nesting beaches has been increasing over the course of the decades, against the background of the past and ongoing human and natural factors that have contributed to the Status of the Species. We believe these nesting trends are indicative of a species with a high number of sexually mature

individuals. In the absence of any total population estimates, nesting trends are the best proxy for estimating population changes. Since the nesting trend information for the SA DPS of the green sea turtle is clearly increasing, we believe the lethal take of up to 7 green sea turtles from the SA DPS during a consecutive 22-year period attributed to the proposed action will not have any measurable effect on that trend. After analyzing the magnitude of the effects, in combination with the past, present, and future expected impacts to the DPS discussed in this Opinion, we believe the proposed action is not reasonably expected to cause an appreciable reduction in the likelihood of survival of the green sea turtle SA DPS in the wild.

Recovery

Like the NA DPS, the SA DPS of green sea turtles does not have a separate recovery plan in place at this time. However, an Atlantic Recovery Plan for the population of Atlantic green sea turtles (NMFS and USFWS 1991) does exist. Since the animals within the SA DPS all occur in the Atlantic Ocean and would have been subject to the recovery actions described in that plan, we believe it is appropriate to continue using that Recovery Plan as a guide until a new plan, specific to the SA DPS, is developed. In our analysis for the NA DPS, we stated that the Atlantic Recovery Plan lists the following relevant recovery objectives over a period of 25 continuous years:

- *The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years.*
- *A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.*

The nesting recovery objective is specific to the NA DPS, but demonstrates the importance of increases in nesting to recovery. As previously stated, nesting at the primary SA DPS nesting beaches has been increasing over the course of the decades. There are currently no estimates available specifically addressing changes in abundance of individuals on foraging grounds. Given the clear increases in nesting and in-water abundance, however, it is likely that numbers on foraging grounds have increased.

The nonlethal take of up to 286 green sea turtles from the SA DPS over a consecutive 22-year period would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not impede achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of the SA DPS of green sea turtles' recovery in the wild.

The potential lethal take of up to 7 green sea turtles from the SA DPS during a consecutive 22-year period will result in a reduction in numbers when capture occurs, but it is unlikely to have any detectable influence on the trends noted above, even when considered in context with the Status of the Species, the Environmental Baseline, and Cumulative Effects discussed in this Opinion. The nonlethal take of 286 green sea turtles from the SA DPS over a 22-year consecutive period would not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not impede achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of the SA DPS of green sea turtles' recovery in the wild.

Conclusion

The nonlethal or lethal captures of green sea turtles associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the SA DPS of the green sea turtle in the wild.

Survival and Recovery of the Hawksbill Sea Turtle

Survival

The proposed action may result in the nonlethal take (i.e., capture) of 6 hawksbill turtles every 3 years over a consecutive 22-year period (from 2022 through 2043), for a total of 44 hawksbill turtles. The potential non-lethal capture of 44 hawksbill sea turtles is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The captures may occur anywhere in the action area, which encompasses only a tiny portion of hawksbill sea turtles' overall range/distribution. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of hawksbill sea turtles would be anticipated.

This Opinion does not authorize any lethal take of hawksbill sea turtles due to the fact that FPL has never reported a lethal take of a hawksbill sea turtle.

We believe the nonlethal take of 44 hawksbill sea turtles during a consecutive 22-year period will not have any detectable effect on the population, distribution, or reproduction of hawksbill sea turtles. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival of this species in the wild.

Recovery

The Recovery Plan for the population of the hawksbill sea turtles (NMFS and USFWS 1993) lists the following relevant recovery objectives over a period of 25 continuous years:

> **Objective No. 1:** The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests on at least 5 index beaches, including Mona Island (Puerto Rico) and Buck Island Reef National Monument (U.S. Virgin Islands).
>
> **Objective No. 2**: The numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least 5 key foraging areas within Puerto Rico, USVI, and Florida.

Although the most recent 5-year review indicates there is not enough information to evaluate the statistical significance of nesting trends, nesting populations are increasing at the Puerto Rico (Mona Island) and U.S. Virgin Islands (Buck Island Reef National Monument) index beaches. Also in the U.S. Caribbean, additional nesting beaches are now being more systematically

monitored to allow for future population trend assessments. Elsewhere in the Caribbean outside U.S. jurisdiction, nesting populations in Antigua/Barbuda and Barbados are increasing; however, other important nesting concentrations in the insular Caribbean are decreasing or their status is unknown, including Antiqua/Barbuda (except Jumby Bay), Bahamas, Cuba (Doce Leguas Cays), Jamaica, and Trinidad and Tobago (NMFS and USFWS 2013).

The status of adults, subadults, and juveniles on foraging grounds is being monitored via in-water research. An in-water research project at Mona Island, Puerto Rico, has been ongoing for 15 years. However, abundance indices have not yet been incorporated into a rigorous analysis or a published trends assessment. In addition, standardized in-water surveys have been initiated within the wider Caribbean (e.g., Pearl Cays, Nicaragua), but the time series is not long enough to detect a trend. In Florida, 2 in-water projects have been ongoing in Key West and Marquesas Keys conducted by the In-Water Research Group and Palm Beach County (NMFS and USFWS 2013).

This Opinion does not authorize any lethal take of hawksbill sea turtles; therefore, we believe the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of hawksbill sea turtles' recovery in the wild.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the hawksbill sea turtle in the wild.

Survival and Recovery of the Kemp's Ridley Sea Turtle

Survival

The proposed action may result in the nonlethal take (i.e., capture) of 24 Kemp's ridley turtles every 3 years over a consecutive 22-year period (from 2022 through 2043), for a total of 176 Kemp's ridley turtles. The potential non-lethal capture of 176 Kemp's ridley sea turtles is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The captures may occur anywhere in the action area, which encompasses only a tiny portion of Kemp's ridley sea turtles' overall range/distribution. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of Kemp's ridley sea turtles would be anticipated.

The proposed action may result in the lethal take of 1 Kemp's ridley turtle every 3 years over a consecutive 22-year period, for a total of 8 Kemp's ridley sea turtles. The potential lethal take of 8 Kemp's ridleys over 22 years would reduce the species' population, compared to their numbers in the absence of the proposed action, assuming all other variables remained the same. The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season. Lethal captures could also result in a potential reduction in future reproduction, assuming at least some of these individuals would be female

and would have survived to reproduce in the future. While we have no reason to believe the proposed action would disproportionately affect females, the loss of up to 8 Kemp's ridleys during a consecutive 22-year period could preclude the production of thousands of eggs and hatchlings, of which a fractional percentage is expected to survive to sexual maturity. Thus, the death of any females would eliminate their contribution to future generations, and result in a reduction in sea turtle reproduction. The anticipated captures may occur anywhere in the action area and sea turtles generally have large ranges; thus, no reduction in distribution is expected from the take of these individuals.

Whether the reductions in numbers and reproduction of this species would appreciably reduce its likelihood of survival depends on the probable effect the changes in numbers and reproduction would have relative to current population sizes and trends. In the Status of Species, we presented the status of the Kemp's ridley, outlined threats, and discussed information on estimates of the number of nesting females and nesting trends at primary nesting beaches. In the Environmental Baseline, we outlined the past and present impacts of all state, federal, or private actions and other human activities in or having effects in the action area that have affected and continue to affect the Kemp's ridley. In the section on Cumulative Effects, we discussed the effects of future state, tribal, local, or private actions that are reasonably certain to occur within the action area.

In the absence of any total population estimates for Kemp's ridley sea turtles, nesting trends are the best proxy we have for estimating population changes. Following a significant, unexplained 1-year decline in 2010, Kemp's ridley sea turtle nests in Mexico reached a record high of 21,797 in 2012 (Gladys Porter Zoo nesting database 2013). In 2013 through 2014, there was a second significant decline in Mexico nests, with only 16,385 and 11,279 nests recorded, respectively. In 2015, nesting in Mexico improved to 14,006 recorded nests, and in 2016 overall numbers increased to 18,354 recorded nests (Gladys Porter Zoo 2016). There was a record high nesting season in 2017, with 24,570 nests recorded (J. Pena, pers. comm. to NMFS SERO PRD, August 31, 2017), then declines in 2018 and 2019, when only 11,090 nests were recorded (Gladys Porter Zoo nesting database 2019). A small nesting population is also emerging in the U.S., primarily in Texas, rising from 6 nests in 1996 to 42 in 2004, to a record high of 353 nests in 2017 (NPS data, http://www.nps.gov/pais/naturescience/strp.htm, http://www.nps.gov/pais/naturescience/current-season.htm). It is worth noting that nesting in Texas has paralleled the trends observed in Mexico, characterized by a significant decline in 2010, followed by a second decline in 2013-2014, but with a rebound in 2015-2017.

It is important to remember that with significant inter-annual variation in nesting data, sea turtle population trends necessarily are measured over decades, and the long-term trend line better reflects the population increase in Kemp's ridleys. With the recent increase in nesting data (2015-17) and recent declining numbers of nests (2010; 2013-14; 2018-2019), it is too early to tell whether the long-term trend line is affected. Nonetheless, data from 1990 to present continue to support that Kemp's ridley sea turtle are showing a generally increasing nesting trend. We believe this long-term increasing trend in nesting is evidence of an increasing population, as well as a population that is maintaining (and potentially increasing) its genetic diversity. We believe these nesting trends are indicative of a species with a high number of sexually mature individuals. Additionally, we have seen positive trends in the status of this species, despite the ongoing operation of the SLNPP.

After analyzing the magnitude of the effects, in combination with the past, present, and future expected impacts to the species discussed in this Opinion, we believe the potential loss of up to 8 Kemp's ridley sea turtles over 22 years will not have any detectable effect on the population, distribution or reproduction of Kemp's ridley sea turtles. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival of this species in the wild.

Recovery

The Kemp's ridley recovery plan defines the recovery goal as: "…conserve[ing] and protect[ing] the Kemp's ridley sea turtle so that protections under the Endangered Species Act are no longer necessary and the species can be removed from the List of Endangered and Threatened Wildlife" (NMFS et al. 2011). The recovery plan for the Kemp's ridley sea turtle (NMFS et al. 2011) lists the following relevant recovery objective:

> **Objective:** A population of at least 10,000 nesting females in a season (as measured by clutch frequency per female per season) distributed at the primary nesting beaches (Rancho Nuevo, Tepehuajes, and Playa Dos) in Mexico is attained. Methodology and capacity to implement and ensure accurate nesting female counts have been developed.

With respect to this recovery objective, the nesting numbers in 2019, indicate there were a total of 11,090 nests on the main nesting beaches in Mexico. This number represents approximately 4,436 females nesting that season based on 2.5 clutches/female/season. The number of nests reported annually from 2010 to 2014 overall declined; however, they rebounded in 2015 through 2017, and declined again in 2018 and 2019. Although we believe there is a long-term increasing trend in nesting that is evidence of an increasing population, the number of nesting females is still below the number of 10,000 nesting females per season required for downlisting (NMFS and USFWS 2015). Since we concluded that the potential loss of up to 8 Kemp's ridley sea turtles over 22 years is not likely to have any detectable effect on nesting trends, we do not believe the proposed action will impede the progress toward achieving this recovery objective. Nonlethal captures of these sea turtles would not affect the adult female nesting population or number of nests per nesting season. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridley sea turtles' recovery in the wild.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the Kemp's ridley sea turtle in the wild.

Survival and Recovery of the Leatherback Sea Turtle

Survival

The proposed action may result in the nonlethal take (i.e., capture) of 3 leatherback turtles every 3 years over a consecutive 22-year period (from 2022 through 2043), for a total of 22 leatherback turtles. The potential non-lethal capture of 22 leatherback sea turtles is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The captures may occur anywhere in the action area, which encompasses only a tiny portion of leatherback sea turtles' overall range/distribution. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of leatherback sea turtles would be anticipated.

This Opinion does not authorize any lethal take of leatherback sea turtles due to the fact that FPL has never reported a lethal take of a leatherback sea turtle.

We believe the nonlethal take of 22 leatherback sea turtles during a consecutive 22-year period will not have any detectable effect on the population, distribution, or reproduction of leatherback sea turtles. Therefore, we do not believe the proposed action will cause an appreciable reduction in the likelihood of survival of this species in the wild.

Recovery

The Atlantic Recovery Plan for the U.S. population of the leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

> **Objective:** The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico, and St. Croix; and along the east coast of Florida.

We believe the proposed action is not likely to impede the recovery objective above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild. As discussed above, an updated analysis from 2018 has shown a reverse in trends, as the Culebra, St. Croix, and Florida nesting populations have decreased in recent years, although the long-term trend in Florida remains positive. It is unclear whether the declines represent a shift in nesting locations, changes in reproductive output, actual declines in the adult female population, or some combination of those factors. Since no lethal take is authorized, we do not believe the proposed action is impeding the progress toward achieving this recovery objective. Thus, we believe the proposed action will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the leatherback sea turtle in the wild.

Survival and Recovery of the NWA DPS of the Loggerhead Sea Turtle

Survival

The proposed action may result in the nonlethal take (i.e., capture) of 729 loggerhead turtles every 3 years over a consecutive 22-year period (from 2022 through 2043). In addition, the proposed action may result in the nonlethal take (i.e., causal injury) of 1 loggerhead turtle every 3 years over a consecutive 22-year period (i.e., 8 loggerheads over 22 years). Taken together, the sum is 5,354 loggerhead turtles. The potential nonlethal capture of 5,354 loggerhead sea turtles is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The captures may occur anywhere in the action area, which encompasses only a tiny portion of loggerhead sea turtles' overall range/distribution. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of loggerhead sea turtles would be anticipated.

The proposed action may result in the lethal take of 1 loggerhead every 3 years over a consecutive 22 years, for a total of 8 loggerhead turtles. This lethal take represents a reduction in numbers. These lethal takes would also result in a future reduction in reproduction as a result of lost reproductive potential. Adult and sub-adult juveniles primarily reside in coastal waters; therefore, we would expect these life stages to be present in the action area. We also expect at least some of these takes would be females that would have survived the other threats and reproduced in the future, thus eliminating those female individuals' contribution to future generations. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2-4 years, with 100-130 eggs per clutch. Therefore, the loss of female sub-adult juveniles that would have survived to adulthood could preclude the production of thousands of eggs and hatchlings of which a small percentage would be expected to survive to sexual maturity. A reduction in the distribution of loggerhead sea turtles is not expected from lethal takes attributed to the proposed action. Because all the potential interactions are expected to occur throughout the proposed action area, the distribution of loggerhead sea turtles is expected to be unaffected.

Whether the reductions in loggerhead sea turtle numbers and reproduction attributed to the proposed action would appreciably reduce the likelihood of survival for loggerheads depends on what effect these reductions in numbers and reproduction would have on overall population sizes and trends, i.e., whether the estimated reductions, when viewed within the context of the environmental baseline, status of the species, and cumulative effects are of such an extent that adverse effects on population dynamics are appreciable. In Section 3, we reviewed the status of the species in terms of nesting and female population trends and several of the most recent assessments based on population modeling. Below, we synthesize what that information means in general terms and in the more specific context of the proposed action.

Loggerhead sea turtles are a slow growing, late-maturing species. Because of their longevity, loggerhead sea turtles require high survival rates throughout their life to maintain a population. In other words, late-maturing species cannot tolerate too much anthropogenic mortality without going into decline. Conant et al. (2009) concluded that loggerhead natural growth rates are small, natural survival needs to be high, and even low to moderate mortality can

drive the population into decline. Because recruitment to the adult population takes many years, population modeling studies suggest even small increased mortality rates in adults and subadults could substantially impact population numbers and viability (Chaloupka and Musick 1997).

NMFS-SEFSC (2009) estimated the minimum adult female population size for the NW Atlantic DPS in the 2004-2008 timeframe to likely be between approximately 20,000-40,000 individuals (median 30,050), with a low likelihood of being as many as 70,000 individuals. Another estimate for the entire western North Atlantic population was a mean of 38,334 adult females using data from 2001-2010 (Richards et al. 2011). A much less robust estimate for total benthic females in the western North Atlantic was also obtained, with a likely range of approximately 30,000-300,000 individuals, up to less than 1 million. NMFS (2011) preliminarily estimated the loggerhead population in the Northwestern Atlantic Ocean along the continental shelf of the Eastern Seaboard during the summer of 2010 at 588,439 individuals (estimate ranged from 381,941 to 817,023) based on positively identified individuals. The NMFS-NEFSC's point estimate increased to approximately 801,000 individuals when including data on unidentified sea turtles that were likely loggerheads. NMFS (2011) underestimates the total population of loggerheads since it did not include Florida's east coast south of Cape Canaveral or the Gulf of Mexico, which are areas where large numbers of loggerheads can also be found. In other words, it provides an estimate of a subset of the entire population. These numbers were derived prior to additional years of increased nesting.

Florida accounts for more than 90% of U.S. loggerhead nesting. FWRI examined the trend from the 1998 nesting high through 2016 and found that the decade-long post-1998 decline was replaced with a slight but non-significant increasing trend. Looking at the data from 1989 through 2016, FWRI concluded that there was an overall positive change in the nest counts although it was not statistically significant due to the wide variability from 2012-2016 resulting in widening confidence intervals. Nesting at the core index beaches declined in 2017 to 48,033, and rose slightly again to 48,983 in 2018, which is still the 4th highest total since 2001. However, it is important to note that with the wide confidence intervals and uncertainty around the variability in nesting parameters (changes and variability in nests/female, nesting intervals, etc.), it is unclear whether the nesting trend equates to an increase in the population or nesting females over that time frame (Ceriani, et al. 2019).

Abundance estimates accounting for only a subset of the entire loggerhead sea turtle population in the western North Atlantic indicate the population is large (i.e., several hundred thousand individuals). Nesting trends have been level or increasing over the years. Additionally, our estimate of future takes is not a new source of impacts on the species; estimated takes at SLNPP are expected to stay largely the same.

The proposed action would remove up to 8 loggerheads over 22 years. These removed individuals represent approximately 0.0021% every year of the low end of the NMFS (2011) estimate of 381,941 loggerheads within the NW Atlantic continental shelf (as opposed to pelagic juveniles on the open ocean). In addition, as we noted above, this estimate reflects a subset of the entire loggerhead population in the western North Atlantic Ocean, and thus these individuals represent an even smaller proportion of the population removed. The number of pelagic juveniles is unknown, but may exceed that of coastal individuals. While the loss of 8 loggerheads over 22

years is an impact to the population, in the context of the overall population's size and current trend, it would not be expected to result in a detectable change to the population numbers or trend. The amount of loss is likely smaller than the error associated with estimating (through extrapolation) the overall population in the NMFS (2011) report. Consequently, we expect the western North Atlantic population to remain large (i.e., hundreds of thousands of individuals) and to retain the potential for recovery, and the proposed action to not cause the population to lose genetic heterogeneity, broad demographic representation, or successful reproduction, nor affect loggerheads' ability to meet their lifecycle requirements, including reproduction, sustenance, and shelter. Thus, we conclude the proposed action is not likely to appreciably reduce the likelihood of this DPS's survival in the wild.

Recovery

The recovery plan for the Northwest Atlantic population of loggerhead sea turtles (NMFS and USFWS 2008) was written prior to the loggerhead sea turtle DPS listings. However, this plan deals with the populations that comprise the current NWA DPS and is therefore, the best information on recovery criteria and goals for the DPS.

The loggerhead recovery plan defines the recovery goal as "…ensure[ing] that each recovery unit meets its Recovery Criteria alleviating threats to the species so that protection under the ESA is no longer necessary" (NMFS and USFWS 2008). The plan then identifies 13 recovery objectives needed to achieve that goal. Elements of the proposed action support or implement the specific actions needed to achieve a number of these recovery objectives. Thus, we do not believe the proposed action impedes the progress of the recovery program or achieving the overall recovery strategy.

The plan lists the following recovery objectives that are relevant to the effects of the proposed action:

> **Objective No. 1**: Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females
>
> **Objective No. 2**: Ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes

The recovery plan anticipates that, with implementation of the plan, the western North Atlantic population will recover within 50-150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the then-declining trends of the NRU, PFRU, and NGMRU. The minimum end of the range assumes a rapid reversal of the current declining trends; the higher end assumes that additional time will be needed for recovery actions to bring about population growth.

Recovery Objective No. 1, "Ensure that the number of nests in each recovery unit is increasing…," is the plan's overarching objective and has associated demographic

criteria. Nesting trends in most recovery units have been stable or increasing over the past couple of decades. As noted previously, we believe the future takes predicted will be similar to the levels of take that have occurred in the past and those past takes did not impede the positive trends we are currently seeing in nesting during that time. We also indicated that the potential lethal take of 23 loggerheads over 22 years is so small in relation to the overall population on the continental shelf (which does not include the large, but unknown pelagic population numbers), that it would be hardly detectable. For these reasons, we do not believe the proposed action will impede achieving this recovery objective.

The proposed action is not counter to the recovery plan's Objective No. 2, "ensure the in-water abundance of juveniles in both neritic and oceanic habitats is increasing and is increasing at a greater rate than strandings of similar age classes." For this reason, we do not believe the proposed action will impede achieving this recovery objective.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the NWA DPS of the loggerhead sea turtle in the wild.

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

The proposed action may result in the nonlethal take (i.e., capture) of 3 smalltooth sawfish every 3 years over a consecutive 22-year period (from 2022 through 2043), for a total of 22 smalltooth sawfish. The potential nonlethal capture of 22 sawfish is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The captures may occur anywhere in the action area, which encompasses only a tiny portion of sawfish's overall range/distribution. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of sawfish would be anticipated.

Survival

No reduction in numbers is expected as the take would be nonlethal. Likewise, no reduction in reproduction would occur as only 22 individuals over 22 years are 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 first reported sawfish take occurred (ISED 2016). The anticipated nonlethal take of up to 22 smalltooth sawfish in 22 years by the SLNPP would not result in the removal of the captured individuals from the general area because the animals would be returned to the ocean. Therefore, the anticipated impacts would not affect the species' distribution.

We believe there would be no reduction in numbers, reproduction, or distribution of smalltooth sawfish from the nonlethal take of up to 22 smalltooth sawfish in 22 years, and the take is not expected to measurably affect the species' status or trends. Therefore, the proposed action is not expected to appreciably reduce the species' likelihood of survival in the wild.

Recovery

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

> **Objective No. 1**. Minimize human interactions and associated injury and mortality;
> **Objective No. 2**. Protect and/or restore smalltooth sawfish habitats; and,
> **Objective No. 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, the nonlethal take of up to 22 smalltooth sawfish in 22 years is expected. The impact of this interaction would be minimized through the requirement for FPL 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. We believe the proposed action is not likely to interfere with obtaining the recovery objectives. Thus, we conclude the effects of the proposed action would not cause an appreciable reduction in the likelihood of recovery of the U.S. DPS of the smalltooth sawfish in the wild.

Conclusion

The effects associated with the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of the U.S. DPS of the smalltooth sawfish in the wild.

7.3 Effects of the Proposed Action on the Likelihood of Giant Manta Ray Survival and Recovery

The giant manta ray occurs throughout the action area and is likely to be adversely affected by the proposed action; therefore, a jeopardy analysis must determine whether the proposed action will appreciably reduce the likelihood of survival and recovery of this species.

Survival

The proposed action may result in the nonlethal take (i.e., capture) of 3 manta rays every 3 years over a consecutive 22-year period (from 2022 through 2043), for a total of 22 manta rays. The potential nonlethal capture of 22 manta rays is not expected to have any measurable impact on the reproduction, numbers, or distribution of the species. The captures may occur anywhere in the action area, which encompasses only a tiny portion of the species' overall range/distribution. Any incidentally caught animal would be released within the general area where caught and no change in the distribution of giant manta rays would be anticipated.

There is currently no accurate population estimate for giant manta rays. Giant manta rays can be found worldwide. The best available data indicate that the species has suffered population declines of significant magnitude (up to 95 percent in some places) in the Indo-Pacific and Eastern Pacific portion of its range. NMFS noted that these declines are largely based on trends in landings and market data, diver sightings, and anecdotal observations. The species is not considered threatened in the Atlantic; however, if the species was hypothetically extirpated within the Indo-Pacific and eastern Pacific portion of the range, only the potentially small and fragmented Atlantic populations would remain. The demographic risks associated with small and fragmented populations discussed in the proposed rule, such as demographic stochasticity, dispensation, and inability to adapt to environmental changes, would become significantly greater threats to the species as a whole, and coupled with the species' inherent vulnerability to depletion, indicate that even low levels of mortality would portend drastic declines in the population.

No lethal take is authorized for giant manta rays. Thus, we believe the proposed action is not likely to appreciably reduce the likelihood of survival of giant manta rays in the wild.

Recovery

Since giant manta rays were recently listed in 2018, a recovery plan for them is not yet available. However, recovery is the process by which the ecosystems of giant manta rays are restored and the threats to the species are removed. Restoring ecosystems and eliminating threats will support self-populating and self-regulating populations so they can become persistent members of the native biological communities (USFWS and NMFS 1998). Thus, the first step in recovering a species is to reduce identified threats; only by alleviating threats can lasting recovery be achieved.

While there is no recovery plan available yet, NMFS has developed a Giant Manta Ray Recovery Outline (https://www.fisheries.noaa.gov/resource/document/giant-manta-ray-recovery-outline). The recovery outline "is meant to serve as an interim guidance document to direct recovery efforts, including recovery planning, for the giant manta ray until a full recovery plan is developed and approved." It presents a preliminary strategy for recovery of the species, as well as recommended high priority actions to stabilize and recover the species.

The interim recovery strategy focuses on (1) stabilizing population trends through a reduction of threats, so the species is no longer declining and (2) gathering additional information on the species' current distribution and abundance, movement and habitat use of adult and juveniles, mortality rates in commercial fisheries (including at-vessel and post-release mortality), and other potential threats that may contribute to the species' decline. The proposed action is not expected to impede the stabilization of population trends for the species. Thus, we believe the proposed action is not likely to impede the recovery of, and will not result in an appreciable reduction in, the likelihood of the giant manta ray's recovery in the wild.

Conclusion

The effects from the proposed action are not expected to cause an appreciable reduction in the likelihood of either the survival or recovery of giant manta rays in the wild.

8 CONCLUSION

After reviewing the current status of the species, the environmental baseline, and the cumulative effects, it is our opinion the proposed action is not expected to appreciably reduce the likelihood of survival and recovery of the listed species and DPS's considered in this Opinion. Because the proposed action is not expected to appreciably reduce their likelihood of survival and recovery, it is our opinion that the proposed action is likely to adversely affect, but is not likely to jeopardize the continued existence of the NWA DPS of the loggerhead sea turtle, the NA DPS or SA DPS of the green sea turtle, the Kemp's ridley sea turtle, the hawksbill sea turtle, the leatherback sea turtle, the giant manta ray, and the U.S. DPS of the smalltooth sawfish.

9 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) of the ESA 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. No incidental take of listed marine mammals within NMFS's jurisdiction is expected or has been authorized under this Opinion. Nevertheless, the NRC must immediately notify (within 48 hours, if communication is possible) NMFS's Southeast Regional Office via this form (https://forms.gle/85fP2da4Ds9jEL829) should a take of a listed marine mammal within NMFS's jurisdiction occur.

9.1 Amount or Extent of Take

We anticipate the continued operation of SLNPP will result in takes of sea turtles, giant manta rays, 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, we anticipate some sea turtles 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 sea 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 Opinion. An animal that survives capture and any causal injury is categorized as a non-lethal take. Non-lethal, causal injuries for sea turtles are categorized as minor, moderate, or severe. Anticipated takes for captures, severe causal injuries, and causal mortalities of sea turtles are quantified (Table 4). 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. SLNPP biologists have been assessing causality of sea turtle captures at SLNPP since 2001.

Table 4. Incidental Take Limits for Continued Operation of SLNPP through 2043[15]

Species	Captures	Causal Injuries	Causal Mortalities
Hawksbill Turtle (*Eretmochelys imbricata)*	6 hawksbills every 3 years	Not Authorized	Not Authorized
Kemp's Ridley Turtle (*Lepidochelys kempii*)	24 Kemp's ridleys every 3 years	Not Authorized	1 Kemp's ridley every 3 years
Leatherback Turtle (*Dermochelys coriacea*)	3 leatherbacks every 3 years	Not Authorized	Not Authorized
NA DPS of the Green Turtle (*Chelonia mydas*)	Up to 741 NA DPS greens every 3 years	Up to 3 NA DPS greens every 3 years	Up to 18 NA DPS greens every 3 years
SA DPS of the Green Turtle (*Chelonia mydas*)	Up to 39 SA DPS greens every 3 years	Up to 1 SA DPS green every 3 years	Up to 1 SA DPS green every 3 years
NWA DPS of the Loggerhead Turtle (*Caretta caretta*)	729 loggerheads every 3 years	1 loggerhead every 3 years	3 loggerheads every 3 years
U.S. DPS of the Smalltooth Sawfish (*Pristis pectinata*)	3 sawfish every 3 years	Not Authorized	Not Authorized

[15] As discussed in Section 5.9 of the Opinion, the 3-year time periods (with the exception of 2040-2043) are as follows: 2022-2024, 2025-2027, 2028-2030, 2031-2033, 2034-2036, 2037-2039, and 2040-2043.

Giant manta ray (*Manta birostris)*	3 manta rays every 3 years	Not Authorized	Not Authorized

9.1.1 Hawksbill, Kemp's ridley, and Leatherback Sea Turtle Take

Based on the sea turtle capture data at the SLNPP, hawksbill 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 6 hawksbills every 3 years, 24 Kemp's ridleys every 3 years, and 3 leatherbacks every 3 years until 2043. No causal injuries or causal mortalities are authorized for hawksbill or leatherback sea turtles. Exceeding these take limits will require reinitiation of consultation with NMFS.

Because there is a history of 4 causal mortalities of Kemp's ridely sea turtles at the SLNPP (all 4 causal mortalities occurred in the late 1980s), and more recently (in 2022), there was a causal mortality of a Kemp's ridley sea turtle, NMFS expects the proposed action may result in up to 1 Kemp's ridley causal mortality every 3 years until 2043. No causal injuries are authorized for Kemp's ridley sea turtles. Exceeding these take limits will require reinitiation of consultation with NMFS.

9.1.2 Green and NWA DPS of the Loggerhead Sea Turtle Take

Based on the sea turtle capture data at the SLNPP, NA DPS green turtles, SA DPS green turtles, and NWA DPS loggerhead 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 the incidental capture of up to 741 NA DPS green turtles every 3 years, up to 39 SA DPS green turtles every 3 years, and up to 729 NWA DPS loggerhead sea turtles every 3 years until 2043. In addition, the continued operation of SLNPP is expected to injure to up to 3 NA DPS green turtles every 3 years, up to 1 SA DPS green turtle every 3 years until 2043, and up to 1 NWA DPS loggerhead sea turtle every 3 years until 2043. All turtles that have sustained injuries (e.g., scrapes) requiring treatment would be sent to a rehabilitation facility after consultation with FWC. Finally, the proposed action is expected to result in causal lethal take of up to 18 NA DPS green turtles every 3 years, up to 1 SA DPS green turtle every 3 years, and up to 3 NWA DPS loggerhead sea turtles every 3 years until 2043. Exceeding any one of the capture, causal non-lethal (i.e., causal injuries), or causal lethal take limits will require reinitiation of consultation with NMFS.

9.1.3 Sea Turtle Takes Not Attributed to 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 operation of the SLNPP will not be counted against the take limits estimated under this Opinion.

9.1.4 Takes of the U.S. DPS of the Smalltooth Sawfish

Based on the smalltooth sawfish capture data at SLNPP and the description of the proposed action, NMFS expects the proposed action to result in the non-lethal capture of up to 3 smalltooth sawfish every 3 years until 2043. Exceeding the capture limit or having a causal lethal take will require reinitiation of consultation with NMFS.

9.1.5 Takes of the Giant Manta Ray

Based on the giant manta ray capture data at SLNPP and the description of the proposed action, NMFS expects the proposed action to result in the non-lethal capture of up to 3 giant manta rays every 3 years until 2043. Exceeding the capture limit or having a causal lethal take will require reinitiation of consultation with NMFS.

9.2 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 any listed species/DPS or destruction or adverse modification of critical habitat.

9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" (RPMs) are measures to minimize the amount or extent of incidental take (50 CFR 402.02). The RPMs and the implementing 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, giant manta rays, and smalltooth sawfish. These RPMs and the implementing Terms and Conditions must be implemented by the NRC and the applicant 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 or the applicant fail 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 the following RPMs are necessary and appropriate to minimize the amount and the extent of the incidental take of sea turtles, giant manta rays, and smalltooth sawfish during the continued operation of the SLNPP:

1. **Minimize Entrainment into the SLNPP Intake Canal**
Entrainment and entrapment of sea turtles, giant manta rays, and smalltooth sawfish temporarily remove these animals from their natural habitats. Some of the sea turtles are also injured and/or killed from the ongoing operation of the SLNPP, and in the case of a causal mortality, these

animals are permanently removed from the population. In order to minimize the amount of take, **the NRC must ensure FPL designs, tests, constructs, and implements a deterrent(s) at the 3 intake structures that will reduce the number of sea turtles entering the SLNPP intake canal. The deterrent(s) selected by FPL must not adversely affect any ESA-listed species under NMFS's purview.**

2. **Minimize Injurious and 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, giant manta rays, and smalltooth sawfish entering the intake canal and documents the injuries that are attributed to biofouling and marine debris during the animal's travel 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 existing monitoring and capture program for sea turtles and smalltooth sawfish entrapped in the intake canal. Giant manta rays must be included in FPL's ongoing monitoring and capture program.

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.

9.3.1 Terms and Conditions

The NRC and the applicant must comply with the Terms and Conditions described below 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 sea turtles, giant manta rays, and smalltooth sawfish, as specified in this Incidental Take Statement (50 CFR 402.14). If the NRC or the applicant do not comply with the following Terms and Conditions, protective coverage for the proposed action will lapse and thereby cause any take of listed species to be in violation of the ESA.

The following Terms and Conditions implement RPM 1:

1) **The NRC must ensure FPL tests a deterrent(s) that are designed to result in at least a 40% reduction[16,17] of protected species take in any 3-year reporting period**. FPL

[16] The 40% reduction in take is based on 2 studies: Wang *et al.* 2010 and Wang *et al*. 2013. In both studies, green sea turtles were used, and they achieved a 40% reduction in bycatch of green sea turtles using gillnets illuminated with green LEDs (Wang *et al.* 2010) and UV LEDs (Wang *et al.* 2013).

[17] In reference to the 40% reduction in sea turtle take, we use the same approach used in Section 5.9 of the Opinion to calculate the incidental take limits. This results in the following thresholds. For hawksbill sea turtles, the Opinion

must consult with NMFS and NRC on the proposed deterrent(s) prior to the first phase of testing (testing could occur either in the intake canal/lagoon or a test tank). The first phase of testing must begin within 1 year from the date of this Opinion. Phase 1 testing must be completed within 1 year from the start date of testing. Once Phase 1 testing is complete, FPL must provide a summary report to NMFS and NRC on the test results.

2) **Once the first phase of testing is complete and FPL has provided a report to NMFS and NRC on the test results, FPL must begin the second phase of testing, which will**

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authorizes FPL to capture up to 6 hawksbills every 3 years until 2043. Based on FPL's allowable take of up to 6 hawksbills between 2022 and 2024, FPL must reduce captures to no more than 4 hawksbills in the 2028-2030 reporting period (40% of 6 hawksbills = 2.4 hawksbills; then we subtract 2.4 hawksbills from 6 hawksbills, and the difference is 3.6 hawksbills, rounded up to 4 hawksbills). The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 4 hawksbills in any 3-year reporting period (i.e., 2028-30, etc.) until 2043. Based on FPL's allowable take of up to 729 loggerheads between 2022 and 2024, FPL must reduce captures to no more than 438 loggerheads in the 2028-2030 reporting period (40% of 729 loggerheads = 291.6 loggerheads; then we subtract 291.6 loggerheads from 729 logerheads and the difference is 437.4 loggerheads, rounded up to 438 loggerheads). The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 438 loggerheads in any 3-year reporting period (i.e., 2028-30, etc.) until 2043. Based on FPL's allowable take of 24 Kemp's ridleys between 2022 and 2024, FPL must reduce captures to no more than 15 Kemp's ridleys in the 2028-2030 reporting period (40% of 24 Kemp's ridleys = 9.6 Kemp's ridleys; then we subtract 9.6 Kemp's ridleys from 24 Kemp's ridleys and the difference is 14.4 Kemp's ridleys, rounded up to 15 Kemp's ridleys). The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 15 Kemp's ridleys in any 3-year reporting period (i.e., 2028-30, etc.). Based on FPL's allowable take of 3 leatherbacks between 2022 and 2024, FPL must reduce captures to no more than 2 leatherbacks in the 2028-2030 reporting period (40% of 3 leatherbacks = 1.2 leatherbacks; then we subtract 1.2 leatherbacks from 3 leatherbacks and the difference is 1.8 leatherbacks, rounded up to 2 leatherbacks). The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 2 leatherbacks in any 3-year reporting period (i.e., 2028-30, etc.). For green sea turtles (see discussion in Section 5.9), FPL is authorized to capture up to 780 green sea turtles every 3 years until 2043. A 40% reduction in the overall take of green sea turtles (i.e., both DPSs) would be 312 green sea turtles. Then we subtract 312 green turtles from 780 green turtles and the difference is 468 green turtles, of which 95% would be from the NA DPS and 5% would be from the SA DPS. Based on FPL's allowable take of up to 741 NA DPS green sea turtles between 2022 and 2024, FPL must reduce captures to no more than 445 NA DPS green sea turtles in the 2028-2030 reporting period (40% of 741 NA DPS green sea turtles = 296.4 NA DPS green sea turtles; then we subtract 296.4 NA DPS green sea turtles from 741 NA DPS green sea turtles and the difference is 444.6, rounded up to 445 NA DPS green sea turtles). The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 445 NA DPS green sea turtles in any 3-year reporting period (i.e., 2028-30, etc.) until 2043. For SA DPS green sea turtles, FPL's allowable take is up to 39 SA DPS green sea turtles every 3 years until 2043. Based on FPL's allowable take of up to 39 SA DPS green sea turtles between 2022 and 2024, FPL must reduce take to no more than 23 SA DPS green sea turtles in the 2028-2030 reporting period [40% of 39 SA DPS green sea turtles = 15.6 SA DPS green sea turtles; then we subtract 15.6 SA DPS green sea turtles from 39 SA DPS green sea turtles and the difference is 23.4 SA DPS green sea turtles. In this case, we rounded down to 23 SA DPS green sea turtles so that the sum of the NA DPS take (445) and the SA DPS take (23) = 468 green sea turtles, which represents a 40% reduction in the overall take of green sea turtles]. The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 23 SA DPS green sea turtles in any 3-year reporting period (i.e., 2028-30, etc.) until 2043. Based on FPL's allowable take of 3 smalltooth sawfish between 2022 and 2024, FPL must reduce captures to no more than 2 sawfish in the 2028-2030 reporting period (40% of 3 sawfish = 1.2 sawfish; then we subtract 1.2 sawfish from 3 sawfish and the difference is 1.8, then we round up to 2 sawfish). The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 2 sawfish in any 3-year reporting period (i.e., 2028-30, etc.). Based on FPL's allowable take of 3 giant manta rays between 2022 and 2024, FPL must reduce captures to no more than 2 giant manta rays in the 2028-2030 reporting period (40% of 3 giant manta rays = 1.2 giant manta rays; then we subtract 1.2 giant manta rays from 3 giant manta rays and the difference is 1.8, rounded up to 2 giant manta rays). The count would start at 0 beginning January 1, 2028; thus, FPL must reduce take to no more than 2 giant manta rays in any 3-year reporting period (i.e., 2028-30, etc.).

take place at the intake structures. A camera must be installed on the largest intake structure (with a 16-ft diameter opening), and a camera must be installed on at least one of the smaller intake structures (with a 12-ft opening) in order to record sea turtle behavior during the second phase of testing. The deterrent(s) must achieve at least a 40% reduction in sea turtle take. The second phase of testing must begin within 2 years from completion of Phase 1 testing and must be completed in 1 year. Once Phase 2 testing is complete, FPL must provide a summary report and video documentation of sea turtle behavior at the intake structures to NMFS and NRC. Once Phase 2 testing is complete, the cameras may be removed from the intake structures.

3) **NRC must ensure FPL implements a deterrent(s) at the 3 intake structures that will result in at least a 40% reduction of protected species take in a 3-year reporting period**. **The deterrent(s) must be operational by January 1, 2028.** Once the second phase of testing is complete and FPL has provided a report and video documentation to NMFS and NRC, FPL must develop a plan and schedule for implementing a deterrent(s) at the 3 intake structures. FPL must submit annual reports to NMFS and NRC that demonstrate at least a 40% reduction of sea turtle take as a result of the deterrent(s). Reasonable deviations from this schedule due to human safety (i.e., severe weather or plant operational issues) are acceptable. If FPL anticipates deviating from this schedule, FPL must notify NMFS in writing. All parties (i.e., NMFS, NRC, and FPL) must agree, in writing, to a revised schedule.

4) **The NRC must ensure FPL develops a monitoring and maintenance plan to inspect routinely, remove debris and biofouling organisms from, and repair, as needed, the deterrent(s)**. This plan must be agreed upon by NMFS, NRC, and FPL. Monitoring results and maintenance activity reports must be sent to Audra.Livergood@noaa.gov.

The following Terms and Conditions implement RPM 2:

1) To implement RPM 2, the NRC must ensure that FPL reports all known captures of sea turtles, smalltooth sawfish, and giant manta rays to the NMFS SERO PRD. If and when FPL becomes aware of any known capture, entanglement, stranding, or other take, FPL shall immediately (within 48 hours of the take) notify NMFS SERO PRD via this online form: https://forms.gle/85fP2da4Ds9jEL829. This form shall be completed for each individual known reported capture, entanglement, stranding, or other take incident. Information provided via this form shall include: the title of the Opinion, the issuance date, and ECO tracking number, SERO-2019-03494, for this Opinion; the species; the date and time of the incident; the general location and activity resulting in capture; condition of the species (i.e., alive, dead, sent to rehabilitation); size of the individual, behavior, identifying features (i.e., presence of tags, scars, or distinguishing marks), and any photos that may have been taken.

2) FPL must promptly (within 48 hours of the take) notify Audra Livergood by e-mail (Audra.Livergood@noaa.gov) and telephone (786-351-2225) if there is a lethal take of a hawksbill turtle, leatherback turtle, smalltooth sawfish, and/or a giant manta ray resulting from plant operations. In addition, FPL must promptly (within 48 hours of the

take) notify NMFS SERO PRD via this online form: https://forms.gle/85fP2da4Ds9jEL829. Consultation must be reinitiated if a lethal causal take of a hawksbill turtle, leatherback turtle, smalltooth sawfish, and/or a giant manta ray occurs.

3) For nonlethal captures of smalltooth sawfish and giant manta rays, FPL must promptly (within 48 hours of the take) notify the following: Audra.Livergood@noaa.gov, NMFS SERO PRD via this online form: https://forms.gle/85fP2da4Ds9jEL829 and manta.ray@noaa.gov (for manta rays only) that includes a general narrative and timeline describing the events that took place, including:
   - Time and location of first observation
   - Data collected - Any notes from data collection
   - Handling time (first observed + time to release)
   - Any observed injury / behavior
   - Condition of the animal at the time of release
   - Photographs of the animal

4) Manta rays are ram ventilators and extended entanglement in the net can lead to death. Therefore, NRC must ensure at least one FPL staff member that is trained by NMFS (or a NMFS designee) in the safe handling and release of giant manta rays is available onsite 7 days per week, 365 days per year between the hours of 6 a.m. and 10 p.m. This individual is responsible for monitoring the primary barrier net for possible manta ray entanglement.

5) Giant manta rays must be handled, tagged, and released back to the ocean per the **Safe Handling, Tagging, and Release Requirements for Giant Manta Rays** (Appendix A) of the Opinion.

6) Within 6 months of the date of this Opinion, NRC must ensure FPL develops 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 sea turtles. This plan must be coordinated with Audra Livergood, NMFS Southeast Regional Office. The plan may take into account human safety as a valid reason for delays.

7) NRC must ensure FPL continues to record the number of captured turtles with fresh causal scrapes and categorize them as minor, moderate, or severe. If, during 2 consecutive years, 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, NRC must ensure FPL starts the process for inspecting the intake pipes, and evaluates and initiates corrective action within 1 month. Reasonable deviations from this schedule due to human safety (i.e., severe weather) or interference with compliance with electrical distribution requirements are acceptable. FPL must contact Audra Livergood, NMFS Southeast Regional Office, if deviations from this schedule are expected.

8) 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.

9) NRC must ensure that 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.

10) NRC must ensure FPL's contracted biologists will 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 sea turtle nesting season (March 1-October 31).

11) 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) A minimum of 8 hours per day, 5 days a week, under normal circumstances
    b) 12 hours a day or during daylight hours, whichever is less; 7 days per week; under any of the following circumstances:
        -an adult turtle 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.).

12) NRC must ensure FPL continues 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 of Hutchinson Island, Florida.

13) NRC must ensure FPL monitors the 3-mile stretch of beach along Hutchinson Island near the release site to assess any possible delayed lethal impacts on captured smalltooth sawfish for 7 days after the release of a captured animal.

14) NRC must ensure FPL continues to conduct, under proper permits and authority, the ongoing sea turtle nesting programs and public service turtle walks.

15) 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.

16) The grating at each intake well must be visually inspected for sea turtles, giant manta rays, 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 or giant manta ray is sighted in the intake wells, the animal shall be safely captured immediately (see Appendix A for giant manta rays). Necessary rescue equipment shall be stored on-site within the protected area to expedite capture of a sea turtle, giant manta ray, or smalltooth sawfish upon sighting.

17) In accordance with the FWC Marine Turtle Permit conditions, FPL must consult with 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 must 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 with FWC to decide 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 SLNPP will not be counted against the authorized causal take in Section 9.1 (Table 4).

18) NRC must ensure 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 (PIT) 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 measurements, tag, and transport the animal back to the Atlantic Ocean. 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.

19) The NRC must ensure that FPL's 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 Opinion. NMFS's 2016 Biological Opinion for the continued

operation of SLNPP Units 1 and 2 will be replaced in full with this Opinion, upon issuance. FPL should request license amendments from NRC to update the Environmental Protection Plans, or NRC should otherwise condition each SLNPP operating license.

20) NRC must ensure FPL continues to submit to NMFS and the NRC monthly and annual reports providing data and statistics on sea turtle, giant manta ray, and smalltooth sawfish entrapment, capture efforts, and injuries/mortalities (causal and non-causal). 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 condenser tube 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 e-mailed to Audra Livergood (Audra.Livergood@noaa.gov) and to the U.S. Nuclear Regulatory Commission.

10 CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations identified in Biological Opinions can assist action agencies in implementing their responsibilities under Section 7(a)(1). Conservation recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

NMFS reiterates the following conservation recommendations in our 2016 Opinion. In addition, we have added giant manta rays and Conservation Recommendation #4. We believe these recommendations are reasonable, necessary, and appropriate, and we strongly recommend that these measures be considered and adopted:

1. The NRC should promote FPL's continued efforts to determine post-capture release information on sea turtles, giant manta rays, 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, giant manta rays, and smalltooth sawfish in the intake canal.

3. The NRC should promote improvements to the CTCS 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.

4. The NRC should promote FPL to publish the results of Phase 1 and Phase 2 testing of sea turtle deterrents in the peer-reviewed literature.

To stay abreast of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

11 REINITIATION OF CONSULTATION

This concludes NMFS's formal consultation with the NRC on the proposed action. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal action 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 on listed species or designated 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 on the listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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Appendix A: Safe Handling, Tagging, and Release Requirements for Giant Manta Rays

These requirements were developed collaboratively with NMFS, Marine Megafauna Foundation, Georgia Aquarium, and In-water Research Group staff with the intent of maximizing the information obtained from released animals while minimizing handling time and ensuring the safety of animals and personnel.

Initial Capture

- If the animal is upside down (e.g., ventral side up) upon initial encounter by staff, take a picture of the belly that shows any unique identifying spots.
- Trained personnel must keep giant manta rays in the water, whenever possible
  - Try to slowly and gently maneuver the animal into shallow water, by either sliding a sling under it to support its weight or encircling it with a "bag" net and pulling it slowly through the water
  - If the eyes and cephalic lobes become entangled, do not put load-bearing force on the animal - try to slowly and carefully maneuver into shallow water
  - Keep manta right-side-up (e.g., dorsal side up) mouth oriented towards flow to oxygenate the gills
- If the animal must be removed from water, support as much of the animal as possible and minimize time out of the water – the animal's weight in gravity may cause injury
  - The safest place to pull is from the front of the pectoral fins - avoid the sides as they can deliver powerful blows.
  - Do not pull manta ray by cephalic lobes, lower jaw, or tail. Although the gill openings are stronger, they should not be used as "handles" unless absolutely necessary. Be extremely careful not to contact the animal's eyes.
  - Use a sling or weighted bag net to get under the animal, allowing a greater spread of weight with haul
  - Can use barrier net to contain the animal in a smaller area and then work on getting control with another net to get under water

Safe Handling

- Establish control of the animal

Georgia Aquarium staff distributed in front and behind large manta to maintain control while avoiding blows from pectoral fins. Note animal is supported in a soft sling and partially submerged to reduce weight on internal organs. Photo courtesy of Chris Schreiber (GAI).

- At all times, personnel should be very careful of potential for injurious blows from pectoral fins
- Do not pull manta ray by cephalic lobes, gill slits, lower jaw, or tail. Be extremely careful not to contact the animal's eyes
- If possible, slide supported sling/soft-bottom stretcher under the manta ray and have at least 2-3 staff on each side, in front of the wings.
- With 3+ staff, distribute 2+ staff to the sides of the head with 1 staff in between the cephalic lobes
    - With 2 staff, have one on each side of the head and maintain control by holding the upper jaw between the cephalic lobes.

- Orient the animal's mouth towards the predominant water flow
    - Supplement flow in shallow water with a pump near the mouth just to keep water running over gills (not at high speed)
        - Do not put pumped water directly into mouth
        - Use integrated aerator or compressed oxygen or airstone near the intake of the pump (125-150% saturation)

Data Collection

- Date and time
- Handling time (first observed + time to release)
- Fresh scrapes (similar to turtle injury tracking; document scrapes as Minor, Moderate, or Severe)
- Measurements
- Disc width = wingtip to wingtip (in cm)

    - Length (mouth to attachment point of tail; in cm)
    - If davit with scale necessary for transport, record weight (in kg), else skip this step
- Photographs and video footage of the animal (KEEP ANIMAL IN WATER)
    - Dorsal photograph
    - Ventral video of unique belly spot patterns (using Go-Pro on extender)
        - Do not flip the animal over, use Go-Pro with an extender to get video belly from underwater
        - Try to get a distance of at least 3 ft (preferably 5 ft) depth under the animal and run the video from the mouth to the tail.
        - Always attempt this in canal
        - Tissue sample (fin clip preserved in Ethanol)
- Submit data to manta.ray@noaa.gov

Tagging

- Attach tag to manta ray when controlled in the shallow water after other data collection.
- Manta ray shall be SPOT-tagged in accordance with NMFS Manta Ray Tagging Procedures (forthcoming).

Release

- Use 2-3 staff or hoist to raise manta ray
- Keep manta as flat and straight as possible when transporting
- When moving out of the water onto boat or transport, use a sling or net to move the animal to provide more body support
    - Pull onto stable large surface or sling while in the water
    - Ensure availability of transport cart/sled that can be towed by available ATVs or other equipment that is capable of supporting the weight of up to a 1,000 lb animal
    - Tow in “manta cart” over the dune, keep manta ray in the water until last possible moment
    - Use GoPro and extender to film release under water, if safety and visibility permits.